ANNALS

OF

SURGERY

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A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE.

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ANNALS OF SURGERY.

FOREIGN BODIES IN THE LUNGS.

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In the battle at Vertienshoomen on the 17th of April, 1900, Mr. H., aged twenty-three years, was wounded in several places by fragments of a lyddite-shell exploding at a few paces' distance. One of the fragments struck him in front of the right shoulder, and in a medial direction penetrated between the second and the third ribs into the right lung.

Examinations by means of X-rays, afterwards confirmed by the operation, showed that this fragment had stopped behind the medial part of the second rib, about 7.5 centimetres behind the front wall of the thorax, and had probably been retained there by the resistance offered by the right main bronchus, together with the large blood-vessels.

At first there were scarcely any symptoms of wounding of the lungs. The wounded man ran as fast as his other wounds permitted over a distance of about 2000 paces, cried with all his might and, as he declared himself, as loud as ever, and was actually heard at a considerable distance. Not until several hours afterwards, when he had been carried away and had had all his other wounds dressed, did he become oppressed, and with open mouth panted for breath. But the oppression soon gave way, and in the evening he could speak again, though with some difficulty. A further five hours' transport over rocks and through ravines, which he went through the next day, did not produce any symptoms to show that he had sustained a wound of his lungs.

This is very different from what was experienced both on the Boer and on the English side in the Transvaal in cases of transport of men suffering from wounded lungs. For such

wounded people the most absolute rest is an imperative necessity. The deeper the English army in its rapid march from Modderrivier to Bloemfontein penetrated into the enemy's country, and the farther the wounded soldiers had to be carried back to the great hospitals, the more grave became the general process of the disease in cases of wounds in the lungs. Thus, for instance, hæmatothorax as a complication increased from 30 per cent. to 90 per cent. ("Surgical Experiences in South Africa, 1899-1900," by Makins, 1901.)

That the transport over so great a distance had no bad effect in this case may be accounted for by the exceptional character of the wound. The large projectile, 4.5 centimetres in greatest dimension, penetrated only to a comparatively little distance into the body; its impact must consequently have been slight. The wound was therefore chiefly a laceration, which, as is well known, is rarely attended with much bleeding.

Unlike the other wounds, the wound in the breast rapidly healed, and in no way required particular treatment. A few days after the wounding, the man coughed up dirty, stinking blood; but the irritation and the expectoration soon decreased. Now and then some rare phlegm came up, at first sometimes of a nauseous, sweetish taste. But after a few weeks this also ceased altogether, and the patient might have thought the wound in his breast completely healed, but that attempts at deep breathing continued to give him pain, which caused him to restrain himself from sneezing as much as possible. One day in June, however, he was seized with a fit of sternutation. He immediately felt something warm in his throat, and upon coughing expectorated some pure blood. From that time on the bloody expectorations repeated themselves, and finally, by the advice of Dr. Bierens de Haan, the patient resolved to go to Holland to undergo an eventual operation.

On the 5th of October, about six months after the wounding, the patient presented himself at the Municipal Hospital at Amsterdam. It was then found that the top of the right lung both in front and at the back emitted a deadened tympanitic percussion-tone, while at the same time before and behind crepitant and sonorous râles were heard. Now and then bloody purulent sputa came up. Any movement of the body, even riding in a tram-car, caused the bloody coughing to increase. The X-rays confirmed

the presence of a foreign body in the lungs, and even one of considerable size. It was found easy to determine pretty accurately the place of the projectile with respect to the thorax. A distinct part of the shadow was covered with the shadow of a small leaden ball, moved to and fro successively on the back and on the breast. The place of this ball was then marked on the skin, both of the back and of the breast. Then the patient was turned with respect to the light-giver and the same process of determination repeated. The line *a b* measured by means of calipers had then only to be divided in the ratio of *a c* and *b d*. (Fig. 1.) The distance of the shell to the front wall of the thorax, measured in this way, was 7.5 centimetres.

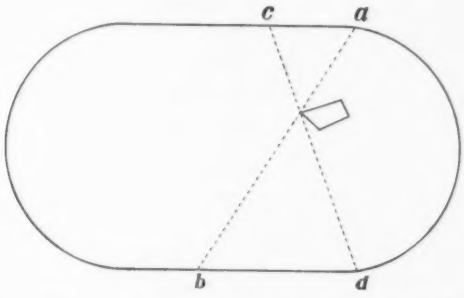

FIG. 1.—Showing distance of shell to front wall of thorax.

Would it be advisable to wait for untoward symptoms before interfering? A consultation of hand-books on military surgery did not give any light. Küttner, in his South African experiences (Bruns, *Beiträge zur klinischen Chirurgie*, Vol. xxviii), does not mention projectiles retained in the lungs. Makins (*loc. cit.*, p. 401) holds that bullets of small calibre are rarely retained in the thoracic cavity. Shrapnel-bullets and fragments of shells, however, were more commonly retained. "The rules to be followed in such cases do not materially deviate from those to be observed in the body generally." "When the bullet is causing no trouble, . . . no interference is advisable. In case of lodgement of the bullet in the lung, bearing in mind the infrequency of untoward symptoms, the latter should be watched for prior to interference."

I am of a different opinion; and I hold that a bullet, as

well as any other foreign body in the lung, deserves attention, even if at first no alarming symptoms should appear. I am strongly convinced that the simple presence of any body in the lungs is to be considered dangerous, and that the only way to prevent operative cures from coming too late is to consider of the highest importance even the slightest symptoms that should manifest themselves.

A few years ago (1896), Hoffmann ("Die Krankheiten der Bronchien, 1896," in Nothnagel's "Specielle Pathologie und Therapie") once more collected the statistics of foreign bodies inhaled into the lungs. He collected some 160 cases, which he classified according to the nature of the bodies. On perusing these lists, we find that if once the foreign body has been expectorated either spontaneously or after tracheotomy, the result was almost generally perfect cure, even after months. Still, the character of the suffering becomes generally the more serious the longer the foreign object had remained in the lungs. In several instances mention is made of expectoration of pus and of the breaking of an abscess in the lungs. Among five cases, in which a sharp-edged, hard body was brought up by coughing after six months or longer, only one patient was completely cured; in two cases the expectoration of pus continued, and in the two remaining cases the end was death from pulmonary disease.

In one of the last two cases a small bone was expectorated after seventeen years, and death followed eighteen months afterwards; in the other case a tooth was expectorated after two years and six months, and the patient died a year after. Only once in all these 160 cases mention is made of a dubious cure without the foreign body being removed either by extraction, by expectoration, or by suppuration. In all the other sixty cases in which the body remained in the lungs, death ensued after a shorter or longer period.

It was an exception, if any patient died within the first hours or days by suffocation. This only occurred with such foreign bodies as are apt to swell, such as beans. Of twenty-nine such cases only twelve were cured, whilst of seventeen of

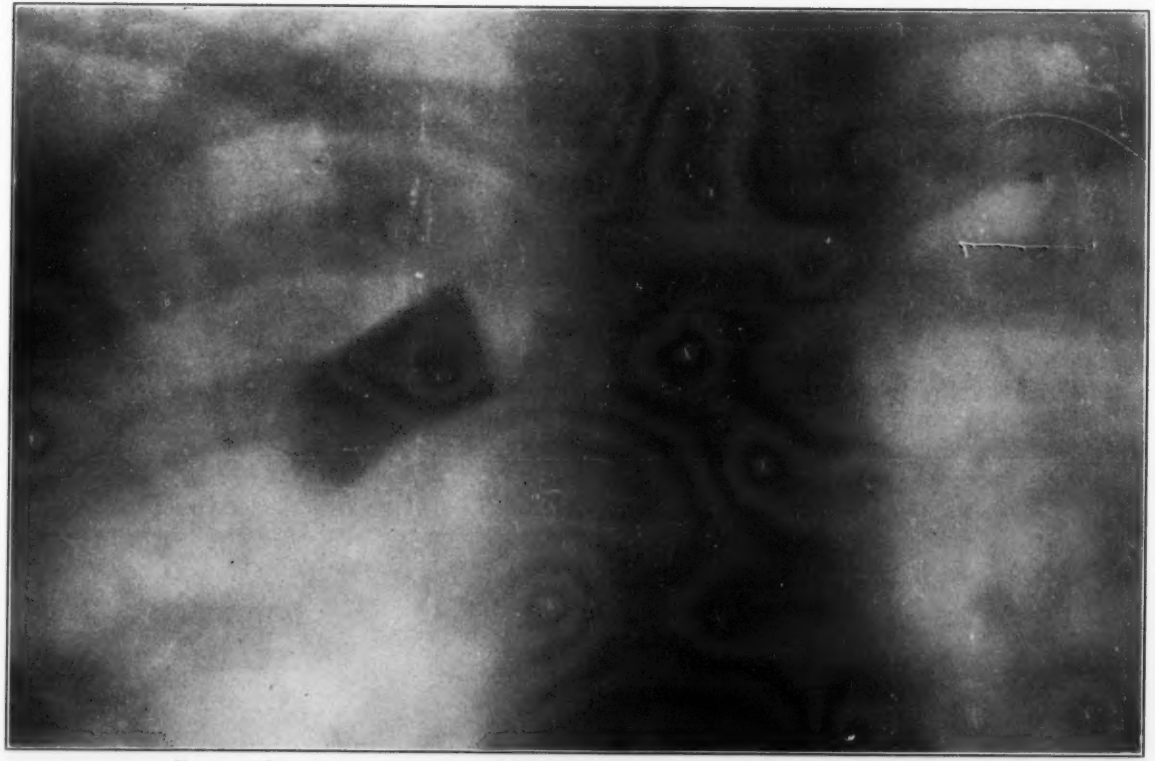

FIG. 2.—Showing fragment of shell embedded in the lung. Anterior view.

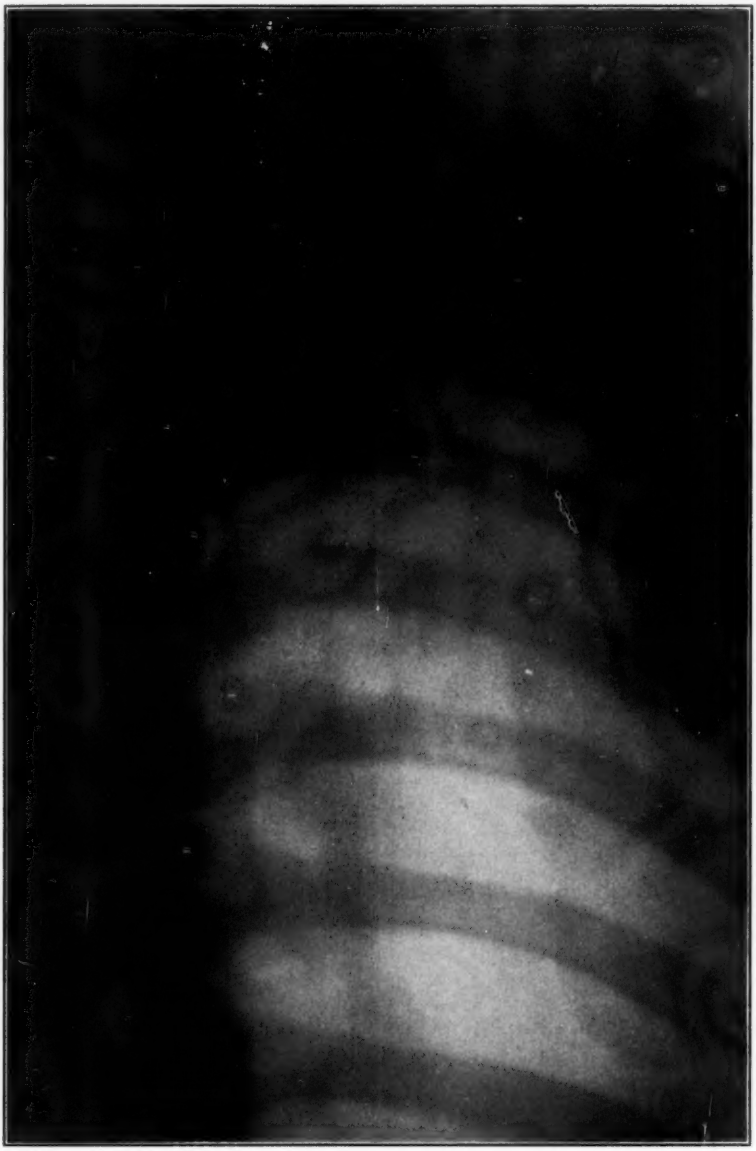

FIG. 3.—Fragment of shell in the lung. Posterior view.

the persons who succumbed, seven died within the first two days, *i.e.*, by suffocation. Some patients died from suffocation after inhaling fruit-kernels. But among sixty-eight patients who had inhaled sharp-edged and pointed objects, we do not find one who died from suffocation. Speedy death followed in thirty cases as the result of further complications, four times even after the object had been coughed up. Among these four are the two we have mentioned above. Suppuration, hectic fevers, coughing with bloody expectorations, and cerebral abscesses are found to have been quite frequent in such cases. As foreign bodies, the inhaling of which was the cause of death, we frequently find small bones, next a set of false teeth, an earring, a bit of slate-pencil, a shirt-pin, but also in two cases pieces of glass, and once a Louis-d'or—bodies which in themselves perfectly admit of being compared with a metal projectile.

From a careful consideration of these data we conclude, in general, that foreign bodies entering through the larynx, if they do not soon cause death by suffocation, may sometimes be borne easily enough for some length of time; that where they are smooth and round and not too large, they are commonly coughed out or removed by tracheotomy; that where angular bodies are soon removed by tracheotomy or by spontaneous expectoration the patient's condition may present a good prognostic, even if the objects have only been removed after months, when suppurating processes had already developed; that the longer the object remained in the lungs, the more serious the consequences were, and that in all cases in which the body definitively remained in the lungs, the final result was the patient's death. Left to itself, any permanently retained body kills the patient slowly but surely. Nor is it difficult to see that it must necessarily be so. Around the foreign body follows decubitus, and behind it retention of mucus; the ensuing inflammation and swelling can only make the situation worse. The increasing retention of mucus and the existing decubitus render the danger of infection more and more serious. In some cases ulceration will

prevail, in others the symptoms of retention of pus and formation of abscesses will be predominant. Besides, the infiltrated bronchus will lose its elasticity and become distended, partly by the forced pressure of expiration in coughing, when the air behind the stenosis comes under higher tension, partly by the continually active atmospheric over-pressure, or, which comes to the same thing, by the negative pressure of the surrounding tissues. In this way bronchial ectases are formed, which are at first somewhat limited, but soon become, under the influence of the same circulus vitiosus, progressive. Lobular pneumonia can only accelerate the destruction of the part of the lungs behind the foreign body.

As soon as this vicious circle of swelling, stenosis, retention of pus, ulceration, and dilatation has clearly begun and is continuing in progress, there is no means to stop the course of the destruction process. Whenever the patient changes his position, large quantities of stinking pus flow in a few moments from the bronchial cavities into the trachea, under the influence of the reflex cough overflow the higher respiratory organs and are thrown out. Sometimes the bleedings become alarming even at an early stage. Hectic fevers exhaust the patient's strength. Percussion and auscultation point to a well defined cavern, which in the end comes near the surface and can be reached by means of an aspiration-needle. As it becomes clearer and clearer that no cure is at all possible without operative treatment, an operation is readily resolved upon, now that the pus is attainable. But even then this operation is anything but simple. A *prima facie* drawback is that in this case, unlike what we find in other pulmonary processes which may necessitate operation (formation of gangrene or of abscesses, after acute pneumonia), there is very rarely any growing together between the two pleural membranes. For the suppurating process is in the centre, and consequently it is only in the very last stage that it attacks the periphery of the lungs.

After a rib resection, which, to facilitate careful examination, must be made somewhat extensive, a large part of the

pleura costalis is laid bare, and, the wound having been tamponed, we wait till the pleural membranes have come to grow together under the influence of the inflammation of the wound. This takes about a fortnight. But during this fortnight the patient is in far worse condition than he was before the operation. By operating without narcosis, the patient may indeed have been secured against extension of the suppurating process by the aspiration of stinking pus into parts of the lungs that had been sound till now. But the same danger is imminent after the operation. Before the operation indeed the patient was in continual fear that every change of position on his part, or the first attempt at coughing, would bring about the evacuation of the quantities of pus which had gathered during his sleep. He dreads the horrid smell and taste of the stuff, and knows that, if very large quantities are brought up, he may be in danger of being suffocated.

But after the operation he also suffers from the pain which the wound of the resected ribs is sure to cause. Hence, a greater dread of expectoration on his part and increased retention of pus with all its concomitants. High fevers, pneumonias, even cerebral embolisms in consequence of suppuration of pulmovenal thrombi, often appear after such first operations. One of my patients who had been operated without general anæsthesia for bronchial ectasy, died of pneumonia a few days after the preparatory operation. In another, a female patient, the symptoms of a cerebral abscess manifested themselves a few days after the treatment of the lungs themselves had begun.

Even when these dangers are passed and the growing together of the two pleural membranes is well on its way, we are not at the end of all difficulties. We put the case, that we have been successful in reaching the pulmonary cavity from without, and that it has been, or at least seemed to have been, sufficiently opened. For now it too often appears that only a very small quantity of pus is discharged through the draining tube, while the bulk of it is expectorated as before.

Moreover, in only one case of Tuffier's statistics (Chirur-

gie du poumon, 1897) was the foreign body itself removed through the wound. Considering that it is generally retained in a main branch of a bronchus, we readily see that its place is too far from the surface for it to be reached in this way. This explains at once why, though the operation may be said to have in a way succeeded, yet no decided benefit is obtained. The operation was intended only to open the ectatic bronchial tree, perhaps even a greatly widened branch of it; but the whole tree, with the foreign body attached to its stem, did not find any discharge worth mentioning along this single branch.

Still, out of eight such operations, it has been my good fortune to obtain nearly complete cures in three cases. Two of these operations took place in cases of bronchial ectasy in consequence of pieces of bone which the patients had swallowed, which bones themselves had probably in both cases already been coughed up, while the third operation was on a pulmonary abscess open to the side of the bronchus, and resulting from pneumonia. Several influences operate together in such cures. The newly made opening serves as a place for the discharge of pus; the air that is sucked in there ventilates the bronchial ectatic cavity; by means of Waldenburg's apparatus I had this air, impregnated with vapors of turpentine and iodoform, forced through the fistula in large quantities.

Through the extensive rib resection the side of the chest above the pulmonary cavity loses its rigidity, the cavity of the lungs can collapse and more completely void itself by expectoration. If the rib resection has been very extensive, the negative pressure in this part of the lung ceases, which caused the inflamed bronchial membrane to be continually distended; thus one of the mechanical causes of progressive formation of bronchial ectasy is removed. The coughing-fits indeed may continue with all their injurious effects, and, since the sick part of the lungs does not find any support, the cough may even have the more dilating power; but the coughing stimulus itself has decreased, and the resistance of the healing bronchial membrane has increased.

With what difficulties, however, such cures are attended

appears from Tuffier's (*loc. cit.*) statistics about the results of external operative treatment of diseases resulting from the aspirations of foreign bodies. In eleven operations four patients died shortly after the operation; not one patient was perfectly cured; only in one case the foreign body, an inhaled button, was removed by the operation, and this patient was cured, with retention of a fistula; in two cases the foreign bodies (a piece of sheep's bone and a hen's vertebra) were coughed up a few days after the operation, respectively fifteen months and two years and six months after the aspiration. Both patients improved so far as to be able to resume manual labor. In the first case, however, pus coughing continued, and in the second a fistula remained. In four other cases the foreign body was not removed; there was still less question of a cure, but the patients felt a great deal better. A twelfth case (Arnolds, Ein Fall von Pneumotomie wegen Fremdkörper; Mittheilungen aus dem Grenzgebiete, 1899, Band vi), in which the button was felt during the pneumotomy and was coughed up a short time afterwards, can be added to Tuffier's list. The ultimate result of this case has not been recorded.

We conclude that these late operations may improve the patient's condition, but they will not effect a cure. It is but natural that these unsatisfactory results induced surgeons to try to remove such foreign bodies as were not soon coughed up before suppuration and bronchial ectasy manifested themselves (Tuffier). But this is easier said than done. Only of late, now that by the Röntgen rays the localization of the foreign body has become possible, we can think of operating in this way with any hope of success; for the aspirated foreign body is always very far from the surface of the lung. To reach it, it is indispensable to open a passage not only through the cavity of the pleura, but also through a thick layer of sound pulmonary tissue. The passage has to go straightway to the foreign body, for there can be no question of finding anything by seeking in the depth of a long, narrow wound. Arnolds records that Bardenheuer was the first to operate at once in such a case, and not quite unsuccessfully.

On March 19, 1898, a cook, T. B., aged twenty-three years, aspirated an artificial tooth. Dreadful coughing spasms followed directly, which repeated themselves for five days with decreasing violence. Not until the fifth day did she apply for assistance, and by means of the X-rays her statement was confirmed, and the exact place of the foreign body ascertained. From the measured displacement of the shadow with a given displacement and a given distance from the light-giver, the distance from the tooth to the back wall of the thorax was estimated at ten centimetres. For two months the foreign body remained lying there unaltered opposite the right seventh rib. According to anatomical investigations, it must have got into a bronchial branch of the third order. In accordance with this was the fact that in case of deep inspiration and expiration the shadow was displaced at least three centimetres, *i.e.,* the body itself at least two and a half centimetres. A spontaneous coughing-up after an unchanged fixation for so long a period was certainly very improbable. In the conviction that delay could be of no use before a large part of the pulmonal tissues had been destroyed, and that it was imperatively necessary to prevent this, it was resolved to proceed to the operation. The 18th of May rib resections were made, measuring five centimetres, from the sixth, the seventh, and the eighth rib, and three centimetres from the ninth rib. Tamponing of the wound till the 8th of June. Then, after having once more examined by means of X-rays, and ascertained once more its exact location, a needle was introduced ten centimetres, and immediately the firm resistance of the hard body was felt. In the same direction a Paquelin was introduced. Having got so far, the needle no longer met with any resistance, consequently the operation was suspended and the wound tamponed again.

On the 30th of June, examination of the lung with X-rays was made while a probe was introduced into the long Paquelin wound. The tooth was found to lie two centimetres above the point of the probe. In accordance with this the Paquelin was introduced. With the probe a hard body was distinctly felt. Tamponing on account of bleeding. Four hours afterwards the tooth was coughed up. The wound healed rapidly.

If in this case the foreign body was not extracted from the pneumotomy wound, the object of the operation, removing the tooth from the lungs, was fully attained.

Returning to our patient, we repeat the question, whether it might be considered advisable to wait any longer. There was an undoubted connection between the bronchial tree and the cavity of the projectile, as was clearly proved by the continually repeated bleedings. The expectorations were at first stinking, and now brown suppurating phlegm was very often brought up. Consequently, there had been infection, and from the last symptoms it might be readily concluded that the infection was there still. Besides, the crepitant and sonorous râles, which manifested themselves in great numbers in the right top, clearly proved that there was something more than compression of pulmonary tissues. Consequently, I took this foreign body to be in the same condition as any other body that had entered through the trachea. But in this case coughing out was next to an impossibility, and bringing out by the formation of an abscess in the chest wall was almost as improbable. It is true that among 160 cases Hoffman had recorded seven cures in this manner, but the objects in question were all of them grains of corn. In a total of seventeen cases relating to grains of corn, still in an eighth case it appeared that the pulmonary abscess extended as far as the liver. It would therefore appear that grains of corn—in consequence of their shape and their tendency to move on in one direction—have a special predisposition to make their way from within by means of an abscess, even if they should have to travel a long way, in one case even to the renal region.

But considering that no such cure was ever effected in the case of any other foreign body, in our case, with so large a shell-splinter, it was not to be thought of. The body had entered from without, but was too large to return the same way. Would not, in general, a bullet having lodged itself in the lungs by penetrating to the more solid parts of the hilus present the same conditions?

If the cavity in which such a body is lodged should be ever so slightly connected with the bronchial tree, I think there must always be a tendency to an enlargement of the cavity and to an increase of the retention of mucus and afterwards of pus.

For a long time the bullet may seemingly cause little trouble; there is always, I think, every reason to fear that finally, like all foreign bodies in the lungs, it will cause progressive destruction of pulmonary tissue, ending in death. That is the reason why in this case I held a bloody removal to be peremptorily indicated.

On the 17th of October the second rib was resected from the cicatrix nearly to the sternum. Then all the tissues of the second intercostal space with the cicatrix in it were cut away. Neither the second nor the third rib was found fractured. Consequently, the shell-splinter must have passed between the two ribs. In trying to follow the cicatrix into the lungs, the pleural cavity was opened; immediately a moist tampon was applied, and the patient's wound dressed. Up to the 29th of October the patient was made to lie on his belly, lest the heavy splinter should come to lie at a greater distance from the front wall of the chest, and thus become fixed.

On the 30th of October another radiographic examination, with the same result as before. It will be necessary to make the perforation along the remaining sternal part of the rib.

On the 31st of October second operation. After one or two unsuccessful attempts, three pins were successively introduced, all of them parallel and at a distance of two centimetres from each other; all struck against a hard object at a depth of four centimetres. Above and under this spot, as deeply as possible by means of full curved needles, thread-loops were passed, with which the deeper tissues were entwined and brought to the surface; all exploratory pins having been removed, these pulmonary tissues were cut. Once more thread-loops were passed and the entwined tissues cut. Then the point of the knife was arrested by the hard body, and dilatation of the incision with director and forceps was made. The finger being introduced, continued the dilatation with the aid of the forceps; the splinter was taken hold of and extracted. Upon further examination there follow still two pieces of cloth. The whole cavity was eleven centimetres deep. Loose tamponing.

On the following days the patient coughed up some bloody sputa, and the wound was dressed every day. In case of cough-

ing, the air flowed out. On the 14th of November, as the wound was being dressed, another piece of cloth was coughed out and removed. On the 1st of December the wound was rapidly healing, and no longer left any passage for the air.

On the 13th of December the patient was discharged as cured. Still, every morning one or two slimy masses of phlegm were expectorated. After a fortnight this did not occur any more, and the patient was in perfect health. On percussion the sound was found somewhat deadened. Auscultation showed weakened

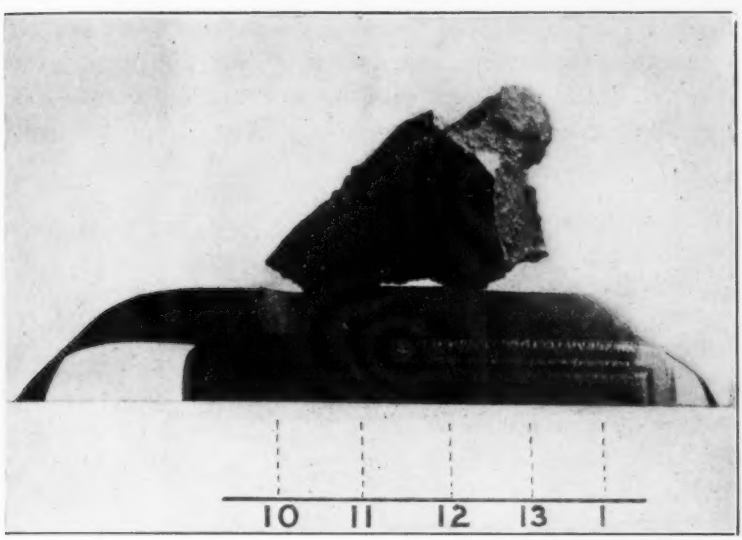

FIG. 4.—Piece of shell weighing forty-two grammes. Removed from lung.

breathing. On the 21st of August, 1901, the most favorable reports were received.

The splinter measures four and a half centimetres in longest dimension, presents a regular upper and under side, with very irregular, sharply-pointed breaking edges, and is about one and a half centimetres thick (Fig. 4). It weighs forty-two grammes.

According to Tuffier's statistics (1897) and Arnolds's paper (1899), this would be the second foreign body extracted from the lungs through an external wound, and this case of

pneumotomy is also the second that may lay claim to the name of "early" operation.

That foreign bodies deeply aspired can also be removed through the trachea has been proved by von Schrötter, who, in the case of a boy of twelve, removed a piece of lead of 3.2 grammes from a bronchial branch of the second order. Under cocaine anæsthesia, von Schrötter introduced a straight tube twenty-four centimetres in length and 6.3 millimetres in diameter through larynx, trachea, and bronchus. At the end of the tube the piece of lead became visible; finally, it was seized by means of a forceps expressly made for the purpose, and removed at the same time with the tube. ("Zur casuistik der Fremdkörper in den Luftwegen," by Leopold von Schrötter, 1901.)

LIGATION OF THE LINGUAL ARTERY THROUGH THE MOUTH IN EXCISING HALF OF THE TONGUE.

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The method to which I wish to draw attention is based on the fact that the hyoglossus muscle, although attached to the posterior third of the tongue, can be reached from the mouth when the tongue is drawn far out and the mucous membrane has been divided between it and the jaw. The operation is performed as follows: The jaws are opened widely; the tongue drawn forward with a stout silk suture in each half; the mucous membrane divided along the middle line of the dorsum, behind the growth, and between the tongue and the jaw; the tongue split; and the fibres of the genio-hyoglossus divided close to the symphysis with scissors so that the diseased half of the tongue can be drawn well out of the mouth.

After this, with a few vertical strokes of a director or other blunt instrument, the anterior edge of the hyoglossus muscle is defined. The director is then insinuated beneath the muscle, the tissues being separated with the point before the instrument is pushed on. The muscle is next carefully cut through on the director for about two-thirds of its extent, and the fibres retracting leave the artery at the bottom of the wound covered only by a little connective tissue. With the point of an aneurism-needle or director the vessel can then be easily defined as a bluish cord, and traced downward and backward. An aneurism-needle should then be passed under

it, and the vessel tied before it is cut. Some may prefer to seize it with forceps and cut before tying it, but the previous ligature is easier. After the artery has been ligatured and divided, a few snips should be made with the scissors radiating out from the ligatured artery into the substance of the tongue. This lessens the chance of cutting the artery again in the later stages of the operation. All that now remains to be done is to complete the operation, cutting wide of the disease.

The advantages of this method are ease and certainty in securing the lingual artery; diminished bleeding from small vessels; greater certainty in cutting wide of the disease; along with an intact condition of the tissues of the neck for subsequent removal of the submaxillary and lymphatic glands, as recommended by Mr. Butlin in the last edition of his admirable work on " Diseases of the Tongue."

In two recent cases of epithelioma of the tongue, I have found this method of securing the lingual artery work admirably. On carrying the procedure out in the dissecting-room, I find that one can reach in this way the same part of the artery that is tied in the usual operation for a preliminary ligature in the submaxillary triangle.

THE TREATMENT OF PROSTATIC HYPERTROPHY ASSOCIATED WITH STONE IN THE BLADDER BY MEANS OF LITHOLAPAXY AND BOTTINI'S OPERATION AT ONE SITTING.[1]

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At a time when the operative methods for the cure of hypertrophy of the prostate gland are under discussion everywhere, a contribution to the treatment of this trouble when associated with stone may not be amiss.

With regard to the operative treatment of hypertrophy of the prostate when not associated with stone, I think it may be said that prostatectomy—by the suprapubic or perineal route, or both combined—and galvanocaustic prostatotomy, the so-called Bottini operation, are the two standard methods employed at the present time.

The question now arising is: Do these methods remain equally useful procedures if vesical calculus or calculi complicate the prostatic trouble?

That prostatectomy holds its own in the presence of this complication goes without saying; the suprapubic method—which here must be the operation of choice—is the most thorough and complete operation that can be thought of. As soon as the bladder has been opened, the stone or stones are lifted

[1] Read before the New York Surgical Society, April 9, 1902.

out and the prostate is enucleated. It is, therefore, evident that the presence of stone in the bladder is apt to still more incline the surgeon in favor of the cutting methods. I say, the suprapubic method must be the operation of choice because it enables us to complete the entire task with but one single vesical incision.

When selecting the perineal route for prostatectomy, one could, of course, combine the same with a median perineo-urethral incision for the purpose of removing a calculus from the bladder. Certainly such an operation could come into question only where a stone of moderate dimensions is concerned.

There are, naturally, many variations that could be thought of. For instance: After perineal prostatectomy has been completed and the bleeding capsule temporarily packed, in the presence of a large vesical calculus, the lithotrite could be introduced through a median urethral incision, the stone crushed and evacuated. The after-treatment is conducted as usual;

Or, a large stone could be lifted out by the suprapubic route and perineal prostatectomy added;

Or, a large stone or multiple calculi could be removed by an incision above the pubes, the wound closed by sutures entirely, or as far as may be deemed advisable, and Bottini's operation added with the incisor introduced through the urethra or through a perineal incision, according to the preference of the operator.

Now, as regards the merits or demerits of Bottini's operation in the presence of stone, I shall try in the following to show just what my experience has taught me.

If a surgeon, who practises both prostatectomy and galvanocaustic prostatotomy, has, in a given case, decided in favor of the latter procedure, the stone in such an event will naturally also have to be removed by means of an intravesical intervention, that is to say, litholapaxy will have to be employed to crush the stone, and Bottini's operation to deal with the enlarged prostate. The only point to be decided then is:

Shall litholapaxy be done at the first sitting and Bottini's operation at a later one, or shall both be combined?

To reverse the procedure, namely, to do Bottini's operation first and crush and evacuate the stone at a later sitting, will surely be but very rarely indicated. Yet it may be advisable in certain cases. If, for instance, the prostatic urethra is encroached upon by the hypertrophied gland to such an extent that the lithotrite will not pass the neck of the bladder without in all probability doing damage, and prostatectomy appears to be contraindicated, it may be well to let Bottini's operation precede litholapaxy. Of course, in such a case the first days following the first operation may be exceedingly troublesome for the attending physician.

It is not my intention to here review the whole literature on litholapaxy and its effects in the presence of an enlarged prostate. I will merely refer to a few of the more recent American writers.

E. L. Keyes, of New York, in a paper read before the New York State Medical Society in 1898 (ANNALS OF SURGERY, 1898, Vol. xxvii, page 571), advocates suprapubic cystotomy for the removal of stone in such cases where a serious revolt of the prostatic urethra is to be expected in consequence of the necessary, prolonged instrumentation, and gouging out the bar and lowering the urethral floor at its beginning for the prostatic trouble. He states that "it should be the surgeon's object to remove the obstructing portion of the prostate rather than to take the organ away in bulk, since the bulk alone generally does little damage." Suprapubic total prostatectomy, in view of its danger, he considers a procedure rarely called for in these cases. (It should be remembered that this statement was made four years ago, when total prostatectomy was not yet as generally recognized as it is to-day.) Litholapaxy he performs only in selected cases, and cites some instances where the patient's condition was seriously aggravated by the introduction of the lithotrite and tube, making suprapubic cystotomy ultimately necessary, whether the fragments were entirely removed or not. Thus, in consequence of litholapaxy,

symptoms had arisen which ordinary surgical means proved unable to overcome on account of existing prostatic disease.

G. Chismore, of San Francisco, on the other hand, never employs any cutting method for stone in prostatics, but practises a modified litholapaxy. That is to say, he crushes the stone at different sittings under local cocaine anæsthesia. He is very careful not to overstep the limits of the patient's power of endurance, but stops just as soon as marked irritability of the bladder has set in, washing away the *débris* as much as possible. He says, "No time limit can be set within which it is wise to desist. Tolerance varies greatly, and the operator should bear in mind that it is better to stop too soon than to incur the risk of lighting up an inflammation by too prolonged manipulation. The number of sittings varies with the difficulties of the case and the skill and experience of the operator. More than three are rarely needed, and after the first cocaine may usually be omitted. After each sitting the patient is directed to rest. Irrigation of the bladder is never done.

In eighty-one cases of litholapaxy reported by Chismore in 1897 (*International Clinics,* 1897, page 222), vesical stone was associated with enlarged prostate sixty-three times, and the catheter had been habitually used by fifty-four of these men. Many of the cases were in a most pitiable condition,—old, worn with pain, showing marked degeneration of important organs, kidneys, liver, and heart.

In this series there was but one fatal case where autopsy showed that operation might have possibly hastened the end, and four patients who had frequent recurrences. Two of these were cut by the suprapubic route to make sure that the bladder was really cleared; in both the lithotomy was quickly followed by new calculi, which were then successfully removed by crushing.

Chismore then seems—at least up to 1897—to direct his attention in these cases to the stone alone, and tries to prevent prostatic irritation by his intermittent method of treatment.

The object of this paper is to show that litholapaxy as originally defined by Bigelow—certainly the operation of

choice for stone of the bladder—may well be done in prostatics; and that no trouble is likely to result in consequence of the hitherto much-feared resentment of the gland to the continued intra-urethral and intravesical instrumental intervention *if Bottini's operation is added at the same sitting.*

A brief recital of various personal experiences that have led up to my present views on the subject may be of interest.

First, I will mention a group of cases, nine in number, where the symptoms of the prostatic enlargement were less pronounced than those created by the presence of the stone or stones. In these cases I removed the stone by suprapubic incision, taking no further notice of the enlarged prostate. Four of these got well without further complication, as far as the healing of the wound was concerned, although the prostatic symptoms continued more or less; two old men above the seventies, treated in 1893 and 1896, with multiple calculi and advanced kidney complications, were permanently drained above the pubes; one, a sufferer from chronic bronchitis, died eight days after the operation, and two developed a persistent suprapubic fistula, which was permanently closed by Bottini's operation, which latter incidentally also cured the symptoms produced by the enlarged gland. The two last mentioned patients have been in perfect health now for two to three years. The performance of Bottini's operation here was not contemplated from the start, but became necessary in the course of subsequent developments.

The second group embraces four cases in which litholapaxy was done under general anæsthesia. One of these derived great benefit from the operation and had no trouble afterwards. In two suprapubic cystotomy had to be added on account of insuperable prostatic irritation which caused intense suffering. In the first of these, who had had but a very small amount of residual urine, the wound healed kindly after a few weeks, and his prostate gave him no further trouble, at least not sufficient to call for surgical aid. The second case developed a persistent suprapubic fistula, which, later, was cured by Bottini's operation, the prostatic symptoms

previously noticed disappearing at the same time. In a third case, in which also the prostatic symptoms caused considerable trouble, I resolved not to do suprapubic cystotomy, but to see what could be achieved by Bottini's operation. It worked like a charm, and the patient was promptly relieved of his suffering.

I feel that in every one of these three cases the serious revolt of the prostate might possibly have been avoided, had I employed Chismore's modification of Bigelow's operation. The irritation felt by the non-narcotized patient surely must represent a reliable indicator as to when it is best for the surgeon to stop for the time being. However, I personally favor methods which enable us to get through with the patient in one sitting, and I hardly feel that I could have made up my mind to use cocaine in such a way as practised—though successfully—by Chismore in his large number of cases. He uses one to two ounces of a 4 per cent. solution of cocaine, which is thrown through the posterior urethra into the bladder, representing two to three grammes (one-half to three-quarters of one drachm) of the drug. In one case he even used as much as ten grammes, or two and one-half drachms, of the drug, injecting a fresh lot whenever the patient began to suffer, and succeeding in thus keeping up local analgesia for as much as three hours. On very few occasions there has been slight toxis; never enough to cause him to suspend the operation.

Personally, I am very cautious in irrigating the posterior urethra with the stronger solutions of cocaine, since, some ten years ago, I came very near losing a patient right at my office due to poisoning by this drug.

However, these scruples are really no longer a subject for consideration, since, in availing myself of the experience I had in the last-mentioned case, viz., that Bottini's operation quieted the irritated gland, I have been able to prove by a third group of cases that, by letting Bottini's operation follow litholapaxy *at the same sitting*, the troubles otherwise so frequently met with can be entirely obviated. Strange as this

may seem, it is nevertheless a fact that, in every one of my cases where litholapaxy has been immediately followed by Bottini's operation, the gland has made no resistance, but seemed actually cowed by the treatment it received. I would compare its behavior with that of a vicious dog, who barks, snarls, sometimes even bites if interfered with, but, being once thoroughly whipped, cowers in submission at his master's feet.

Although so far I can place before you the histories of only three such cases, I nevertheless venture to believe that further experience will not refute the observation I have made.

CASE I.—J. S., aged fifty-five years, much reduced by many years' suffering from urinary disease. Examination May 28, 1898, searcher touches stones. May 30: Suprapubic lithotomy; transverse skin incision; fifty-five facetted stones (urates) removed. A large and soft prostate with pronounced median lobe bulging into bladder is not interfered with. Uninterrupted recovery. A suprapubic fistula establishing itself, treatment was advised. Patient lost sight of. He returned two years later; while his general condition was much improved, the suprapubic fistula had persisted and a ventral hernia had appeared at the site of operation, principally due, it seemed, to the continued pressing, when urinating. Almost the entire urine passed per urethram in weak stream; a few drops are lost above. Call very frequent and painful of late. Cystoscopy demonstrates the prostate of same dimensions as two years previously, and the presence of four stones. Attempts to grasp these with instruments introduced through the suprapubic fistula, also with the lithotrite of the operating cystoscope, are unsuccessful. November 11, 1900, litholapaxy, under spinal anæsthesia with cocaine, plus Bottini's operation at same sitting. No permanent catheter. Uneventful recovery. Suprapubic fistula closed definitely on tenth day after operation. Cystoscopy, performed six weeks later, shows bladder absolutely free from *débris*. Patient returns home, not heeding advice to have the bladder irrigated. Last examination April 29, 1901. He then urinated every two to three hours without pain or discomfort; nights once or not at all. He feels excellent, and considers his bladder trouble cured. Suprapubic fistula remained

closed. The only annoyance is the ventral hernia, operation for which is refused.

CASE II.—H. G., aged sixty years. March, 1894, cystoscopy, which is done on account of continued vesical irritation in the presence of an enlarged prostate. It reveals a small vesical calculus and a pronounced middle lobe. A rather serious and prolonged attack of urethral fever follows. In view of the fact that at that time suprapubic cystotomy was the only means at our disposal in the event of a rebellious prostate after litholapaxy, it was decided not to crush the calculus and wash out its *débris*, but to remove it entire by the suprapubic route. The operation was done on April 6. Uneventful recovery. During the following three years the bladder was treated on and off. Symptoms of chronic spermatocystitis are noticed. Cessation of all treatment until the latter part of 1900, when vesical symptoms again have become aggravated and residual urine increased. Self-catheterization recommended by another surgeon. When seen by me, January, 1901, very frequent micturition; spontaneous urination equals fifty cubic centimetres, residual urine 100 cubic centimetres; relief following catheterization lasts barely two to three hours. In view of the former experience, cystoscopy was abstained from. The patient is opposed to a cutting operation. Therefore, Bottini's operation on January 24, 1901, under general anæsthesia, the latter at special request. Beak of incisor cannot be made to hook middle lobe in the median line; posterior groove through body of gland is, therefore, cut at interstice between middle and left lateral lobe. No reaction. Condition at end of third week after operation: Bladder holds easily 300 cubic centimetres (ten ounces); residual urine still present, but varying. Irritation at neck of bladder much reduced. March 15, a small stone is found in the eye of the catheter after irrigation, clearly a chip of a larger calculus. Now cystoscopy, March 19, carried out after careful internal medication. A medium sized single calculus is seen in the fundus; a piece of its outer coat is chipped off. Twenty hours later chill, which is followed by an attack of urethral fever lasting over a week. Internal medication continued. April 1, litholapaxy and Bottini's operation, under general anæsthesia. Middle lobe again cannot be grasped by the beak of the incisor. Posterior incision, therefore, repeated between middle and left lateral lobe; also again two lateral inci-

sions. Permanent catheter for forty-eight hours. In second half of third day, chill, followed by fever which lasted over one week. Blood-test negative. Prostate causes no irritation. In view of the tendency to develop urethral fever, the usual aspiration through the evacuating catheter, one to two weeks after the operation, or cystoscopy is desisted from for the present. October 10, 1901, patient urinates every two to three hours during the day; nights once or not at all. Bladder holds easily 300 cubic centimetres; residual urine less than one ounce. March 29, 1902: The same condition, but now and then sudden calls. Therefore, cystoscopy on April 7. There is no particle of stone; prostate bleeds somewhat from the interstice, where the cystoscope rests. The irritation, which appears intermittently, is probably due to catarrh of the posterior urethra and the chronic spermatocystitis.

The history of these two patients, treated at a period which marks the most rapid evolution in the teachings on the operative treatment of hypertrophy of the prostate, incidentally also when associated with stone, nicely illustrates the rather roundabout way, formerly sometimes pursued, in order to effect a cure. To-day, I should have told these patients that the most radical intervention for the relief of their trouble is suprapubic or combined prostatectomy, which, at the same time and in the simplest manner imaginable, enables the surgeon to remove the calculus or calculi present.

This would have been my advice to-day, provided I had found the consistency of the prostate gland such as to have made enucleation seem the operation of choice. Had the patients objected to the cutting operation, or had galvanocaustic prostatotomy appeared to me indicated, I should have pointed out to them that litholapaxy plus Bottini's operation also offers good hope for recovery.

My third case shows how comparatively simple the latter procedure may be.

CASE III.—X. Y., aged seventy-four years. Urinary trouble for several years; of late hæmaturia; intermittent attacks of bronchitis. Large double inguinal hernia. Hypertrophied gland well palpable per rectum. Cystoscopy, February 14, 1901: Large

intravesical prostate without median lobe; stone of considerable size in fundus. Litholapaxy plus Bottini's operation, under spinal anæsthesia with tropacocaine, advised. Various consultants favor suprapubic lithotomy, with or without prostatectomy. The last consultant, who saw the patient just before the operation, changes his opinion in favor of intravesical intervention, in view of the complicating large inguinal herniæ. Operation as originally proposed carried out on April 24 under perfect spinal anæsthesia. Uninterrupted recovery; no urethral fever. Permanent catheter removed after three times twenty-four hours, when spontaneous urination set in. To-day patient is in splendid condition. He too experiences rather sudden calls at times. The bladder has not been tested with any stiff instruments so far.

The following interesting experience met with in the course of this operation I think is well worth recording.

The curve of the evacuating catheter did not correspond to the shape of the prostatic urethra; the beak encountered opposition when it reached the anterior triangular ligament. After a while it entered the bladder, the patient's hips then being supported by a pillow: a little fluid only runs off and the tip of the instrument can be palpated directly under the linea alba, up to two inches below the umbilicus.

Conclusion: Probable instrumental perforation of anterior urethral wall, at the distal circumference of the prostate, with tip of catheter in cavum Retzii. Catheter is withdrawn and one of different shape introduced. Evacuation of *débris* perfect. After Bottini's operation, incision down to prevesical space. Not a drop of fluid or bloody serum found.

A similar experience I had last summer when about doing litholapaxy in a prostatic whose bladder symptoms were principally referable to stone. After the lithotrite was introduced with some difficulty, the patient's pelvis being raised by a pillow, the tip of the beak was palpable directly under the skin, as it were. The stone was grasped, nevertheless. On second thought I changed my operating plan and made a longitudinal incision, searching most scrupulously for symptoms of perforation. None was found. The prevesical space was absolutely dry and normal.

Deceiving as this phenomenon may be, it is not difficult to explain. In many men, suffering from hypertrophy of the prostate, the prostatic urethra is elongated to such an extent that the vesical viscus, even when scantily filled, is considerably pushed up towards the abdominal cavity with its vertex near the umbilicus. The tip of an instrument, especially of one with a long beak, curved almost at a right angle with the shaft, the handle of which had to be pressed down considerably on introduction, will be much raised by the bulging gland, and thus pushed against the abdominal wall. Palpation of same through the abdominal parietes may then be very misleading.

As shown by subsequent operation, not the slightest injury had been done to urethra or bladder wall in either of my cases.

I shall certainly bear these incidents in mind for future occasions, and shall not again be alarmed by a like observation, so long as I know that the instrument was introduced with the necessary care.

These cases show that the complex trouble—stone associated with hypertrophy of the prostate gland—can be successfully treated intravesically also, that is, by litholapaxy plus Bottini's operation at the same sitting.

It is true I have but three cases at my disposal on which to base my claim. However, Chismore's sixty-one cases of modified litholapaxy in prostatics, many of them representing far advanced cases with decomposed urine, etc., also demonstrate, that dexterity, aided by useful instruments, can relieve or remove the symptoms produced by vesical stone without a cutting operation, even in this class of sufferers.

The benefit of intravesical treatment, with its greatly reduced risk, is evident, especially when it comes to older patients. Age, as is well known, does not represent a contraindication to Bottini's operation. It, therefore, seems to me that the combined operation under discussion is destined to compete with that of suprapubic lithotomy plus subsequent prostatectomy.

The future will have to show which of the two procedures deserves the preference in the given case, just as this question is still undecided with regard to Bottini's operation and prostatectomy in the uncomplicated cases. In all probability we shall always have to individualize in the one class as well as the other.

As far as my three patients are concerned, I can conscientiously say that every one of them is entirely satisfied with the result obtained.

No doubt the procedure under discussion lacks the brilliancy of the cutting methods, but—to use Chismore's words as applied by him to his modified litholapaxy—" it is entirely feasible to any one who has the gift of patience, a gentle hand, some mechanical tact, and the proper professional training."

It certainly must be of value to the surgeon to know that there are now two useful methods at our disposal for the cure, or at least relief, of this class of patients, and that both can be carried out at one sitting.

TRANSVESICAL CAUTERIZATION AS A SUBSTITUTE FOR THE BOTTINI OPERATION IN THE TREATMENT OF SOME FORMS OF PROSTATIC HYPERTROPHY.[1]

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The treatment of hypertrophy of the prostate gland has been, until recently, distinctly palliative. Operative procedures have been advised only as measures of last resort when the obstruction or some of the secondary pathological processes incident thereto have threatened the life of the patient.

The practicability and value of various operations have been so frequently demonstrated, even in cases of apparently hopeless gravity, that surgeons generally now advise operative measures as affording the most rational means of treatment for this distressing condition.

Having demonstrated the practicability and rationality of operative treatment, attention should now be directed to perfecting the operative technique and to convincing the general practitioner, into whose care these cases first come, that prolonged catheterism, even under the most favorable circumstances, is a dangerous practice; that operative measures are safe and effective, and that the earlier they are employed the safer the treatment and the more gratifying the immediate and permanent results.

The views of writers as to the relative value of these operations vary with their conception of the conditions which cause the obstruction, and as to the immediate and permanent effects of the different procedures upon the local tissues, and also as to the ease and relative safety of the operations them-

[1] Read before the Chicago Surgical Society, February 3, 1902.

selves. Fenwick,[1] for example, believes that 90 per cent. of prostatic obstructions are due to enlargement of the middle lobe. Hutchinson,[2] McGill,[3] Kummel,[4] and Browne[5] believe intravesical enlargement to be the principal cause of obstruction. The experiments of Von Kittel[6] demonstrate the effects of lateral enlargements, which is confirmatory of his clinical observations and those of many others.

In attempting to ascertain the relative merits and safety of the various procedures now employed, we naturally study the published statistics in connection with the technique and applicability of the individual operations. While the statistics demonstrate that most of the operations are reasonably safe, and of distinct value when employed in proper cases and in accordance with the well established rules of prudent surgery, they are very unsatisfying as to the relative merits of the various operations. When surgeons of great prominence differ widely as to the mortality rate of an operation, even when based upon the same tables, the unreliability of the conclusions must be apparent.[7]

The more one attempts to harmonize the different conclusions, the stronger is he impressed with the lack of judicial consideration of the real merits of the cases by those who have presumed to make deductions therefrom. The results are such as we would expect from over-enthusiastic partisans rather than from scientific searchers for the facts. It must have been statistics such as these which long ago called forth the observation "that you cannot prove anything by numbers."

As indicated in the title of this paper, it is not my purpose to discuss the indications for and the relative merits of the numerous operative procedures which have been and are now being advocated for the treatment of prostatic hypertrophy, but simply to call attention to some of the objections to the Bottini operation as now performed, and to advocate the application of the cautery through a suprapubic cystotomy opening as a substitute for the urethral route in some of those conditions in which the Bottini operation seems to have been particularly successful.

Professor Bottini first employed the galvano-cautery in the treatment of hypertrophy of the prostate in 1872, nearly thirty years ago.[8] Notwithstanding its repeated performance and the publication of the procedure,[9, 10] it did not seem to meet with general recognition as a feasible procedure until about 1897, although Clarke[11] had reported three cures in four cases in 1892, and Freudenberg and a few others had been employing it considerably.

The original Bottini instrument has been largely replaced by the Freudenberg modification. The improvement recently devised by H. H. Young,[12] of Baltimore, would seem to justify the early substitution of his modifications for the Freudenberg model, as it adds greatly to the safety and accuracy of the operation.

It was the evident purpose of Bottini to utilize the element of destruction of tissue as a means of immediately removing the mechanical obstruction to urination, and, secondarily, to obtain diminution in the size of the enlargement as a result of the modification of its circulation and of the cicatrization which would follow the deep cauterization, just as is experienced when the cautery is employed to hypertrophied tissues in the nose.

There can be no question but that any form of prostatotomy which removes the immediate mechanical cause of the obstruction will afford temporary relief. The question, however, upon which much doubt is entertained, and which has been the subject of much discussion is, "What is the permanent effect of the cauterization upon the general hypertrophy or enlargement of the gland?"

If in addition to immediately relieving the obstruction it causes permanent shrinkage of the gland and prevents recurrence of obstruction, as claimed by its enthusiastic supporters, then we must all agree that the Bottini idea of cauterization is correct in principle, although we may choose to criticise and to absolutely reject his method of applying it.

The great question is as to the value of the cauterization; the method of application, of which we are to treat, is really

of secondary importance, but, nevertheless, essential to the success of its application.

In the first seventy-seven cases operated upon, Bottini [13] reported fifty-two (67.6 per cent.) as completely cured; eleven (14.3 per cent.) as improved; twelve (15.6 per cent.) as not benefited, with a mortality of two (2.6 per cent.).

Freudenberg collected reports of 752 cases, in which the result was good in 86.6 per cent., a failure in 6.7 per cent., with a mortality of about 4.5 per cent.[14] Bangs [15] reports forty-two Bottini operations. Over 60 per cent. had discarded the use of the catheter, about 20 per cent. had been benefited and 20 per cent. were not benefited, and of these three died from shock and sepsis.

H. H. Young [12] would leave us to imply that of forty-one cases all were improved except the three who died, all of whom were in very bad condition before the operation.

Kreissl, in a personal communication, reports sixty-five operations with forty-one (63 per cent.) satisfactory results, four being after repeated operations; fifteen (23 per cent.) improved as to tenesmus, calls to urinate, and reduced urine; three (4.6 per cent.) not benefited and two (3 per cent.) deaths.

Such reports are certainly most gratifying, and, as Young states,[12] "if correct, undoubtedly shows much better results than can be claimed for any other operative procedure."

To these statistics should be added the experience and careful analysis of Horwitz.[16] He reports thirty-three operations without mortality. Of fourteen cases requiring catheterization, but free from secondary pathological changes, all made perfect recoveries. Of eight cases with beginning bladder changes and constant use of catheter required, but patients in good condition, five were cured, two improved, and one benefited as far as reduction of residual urine. Of twelve cases complicated by marked pathological changes in the urinary tract, in men of advanced years who had reached the "breakdown of catheter life," and some of whom had been subjected to castration, three were markedly benefited, practically cured;

seven continued to use the catheter but with comfort, and with improvement in general health in four, while two were unbenefited.

This presentation would seem to justify positive affirmative conclusions as to the value of cauterization in proper cases, and to conclusively demonstrate that in early cauterization we have a safe and effective means of removing the factors of beginning obstruction, and thus to prevent those dreadful secondary processes which cause so much progressive annoyance, disability, and suffering which is frequently relieved only by death. If the further elapse of time will confirm the permanency of these results, then considerable of the air of doubt which now attains in the treatment of prostatic hypertrophy will have been dispelled.

If intravesical cauterization is efficient, is it equally indicated in all varieties and degrees of hypertrophy or only in a limited number? Even genito-urinary specialists seem to differ as to the scope of its application. Some, including Kreissl, of our own city, restrict its indication to true hypertrophy of only moderate degree of either or all of the three lobes. He believes prostatectomy indicated in true tumor formation and for pedunculated enlargement of the middle lobe. Young [17] evidently believes it is indicated in all varieties of hypertrophy, even when there is valvular formation. Horwitz [18] states that the Bottini operation is indicated in all forms and characters of hypertrophy except when there is valvular formation or great enlargement of all three lobes with marked pouch formation. His conclusions are that the benefits of the operation are equally noticeable in all varieties of enlargement, the glandular or adenomatous as well as in fibroid hypertrophy.

Where the enlargements are situated in the lateral lobes and have extended towards the rectum, the perineal route would seem to be the natural one, while intravesical cauterization would hardly seem sufficient to cause atrophy and shrinkage of a growth far removed from the point of treatment. On the other hand, growths that project towards or into the bladder would seem to be best attacked from the vesical aspect,

preferably through a suprapubic cystotomy opening as first advocated by Belfield in this country and McGill in England.

Assuming, then, that these remarkable statistics and the universal indications are correct, and that the Bottini principle of galvano-cauterization effects the desired changes, have we in the Bottini method of operating through the urethra the safest, most reliable, and generally applicable method of cauterization?

It is unnecessary to go into anatomic details in connection with this subject before the members of this Society, and I will, therefore, merely state that one should keep in mind the relationship of the urethra, prostate, bladder, rectum, vascular plexuses, and other contiguous structures in considering the use and danger of any instrument or method of operating in this locality.

The following disadvantages and dangers of the Bottini operation are worthy of consideration:

(1) *Uncertainty in Diagnosis.*—The location and relationship of the prostate prevent its inspection, and ordinarily its complete palpation, even in the normal subject. The distortion of its form, the length and size of the urethra, and the relationship of the pelvic structures positively prohibit accurate determination of the exact extent and degree of involvement by the hypertrophic process in the majority of cases. The implication made by Horwitz that the diagnosis of the character of the enlargement and the cause of the obstruction can always be determined by rectal manipulation is refuted by all surgeons who have attempted to confirm their digital diagnoses by cystotomy. Even with the assistance of the cystoscope this is not always possible. Kreissl and others rely upon the sound and cystoscope for the diagnosis of enlargements extending towards the bladder. That the urethra is so elongated and distorted as to prevent cystoscopic examination is a fact of not infrequent observation. Furthermore, even when the cystoscope can be introduced, its presence alone should so modify the internal relationships about the vesical neck as to defeat the accurate determination of the factors producing the

obstruction. Rectal examination is of value in determining the condition of the enlargement extending towards the rectum. The sound and cystoscope are of value in some cases where the enlargement projects into the bladder, but in a considerable percentage of this form of enlargement suprapubic inspection and manipulations are absolutely essential to a positive diagnosis.

(2) *Unusual Knowledge and Skill in the Use of Electricity and the Special Instruments required.*—The successful performance of the Bottini operation requires a degree of familiarity with the manipulations and use of a delicate instrument, as well as with the effects of the strong electric current under peculiarly disturbing circumstances, which the ordinary experience of a general surgeon would rarely enable him to acquire. It will certainly not be claimed by anybody that the use of electricity in this manner is an absolutely safe procedure in the hands of every operator.

(3) *Uncertainty as to the Exact Location of the Beak of the Instrument.*—In the first place, without a positive anatomic diagnosis one would not know just where to place the beak of the instrument. Secondly, knowing the conformity of the parts, there are no means of our definitely determining the proper position of the instrument. Some operators claim that the finger placed in the rectum is sufficient, others that it is worthless. All admit having been mistaken even at times when they were positive as to the proper placing of the beak. Even placing the beak by the aid of a suprapubic opening does not insure its remaining there, as has been experienced by Eisendrath and others. The beak became caught in one of Freudenberg's cases and the cautery burned its way into the rectum, causing death.[12] All the conditions would naturally lead any one considering this subject in a judicial manner to conclude that the absolutely positive placing of the beak is impossible.

(4) *There must also be Uncertainty as to the Tissues in the Grasp of the Cautery.*—Even Freudenberg has incised a fold of the bladder,[12, 18] which accident was followed by death.

Young [12] states that the beak has been drawn into the prostatic urethra several times, and that it had resulted in death in several instances by causing division of the membranous urethra, hæmorrhage, and extravasation. He claims having obviated the accident in several of his own operations by following Freudenberg's suggestion of rectal exploration with the finger before applying the current.

(5) *Uncertainty as to the Proper Length of the Incision.*—With an uncertain, and frequently mistaken, diagnosis as to the size and conformity of the enlargement, the length of the incision required cannot be definitely determined. Too long incisions are credited with having caused rupture of the membranous urethra and fatal hæmorrhage in several instances.[12]

(6) *Uncertainty as to Temperature of the Knife.*—All seem agreed that it should be kept at a white heat. Great difficulty has been encountered in securing the desired heat without endangering the adjacent structures and the urethral tract. Lewis has advised the use of air instead of water for distending the bladder in this connection. Young,[19] claiming that this was due to faulty instruments, has devised new ones which he claims to be satisfactory. As the blade cannot be seen, however, there must ever remain marked uncertainty as to the degree of heat in the blade while in operation. This, according to von Frisch,[20] accounts for some of the failures of the operation.

(7) *The Uncertainty as to Destruction of the Tissue.*—Even with the requisite white heat assured, which as yet seems uncertain, there is the uncertainty as to the destruction of the tissue. Horwitz [21] noted that longer time was required with each additional incision, and demonstrated that frequently a full minute was required after removal of the instrument to burn off the adherent tissue. He now removes the instrument after each cauterization. Von Frisch [20] claimed to have been unable in one case to penetrate an enormously enlarged gland with the blade. Unless the degree of heat is very high, it would seem very difficult, if, indeed, not impracticable, to

divide a very firm fibrous enlargement within a safe limit of time.

(8) *The Danger of Bending of the Blade.*—In 1895 I had the privilege of witnessing Professor Czerny, in Heidelberg, perform his first Bottini operation, and there I had the opportunity of noting this accident and observing its serious results. After making his incision, he attempted to return the knife into the beak, but encountered some difficulty, which, however, seemed to be overcome, and the instrument was withdrawn. It was noted that it required unusual traction to withdraw it, the cause of which was incidentally discussed but not definitely decided upon until complete withdrawal had been effected. When removed it was discovered that the blade was bent nearly at a right angle. The removal was, of course, followed by a profuse hæmorrhage, as the bent cautery-blade had split the urethra its entire length. The occurrence of this accident in the hands of this distinguished surgeon, whose reputation as a careful, painstaking operator—indeed, as a veritable master of operative technique—is of world-wide reputation, impressed me with this danger of the Bottini operation *via* the urethral route.

That the operation was distinctly an unsurgical procedure, I was fully convinced, and whenever opportunity has been afforded I have taken occasion to express that conviction. That it may have its sphere of application I am willing to admit, but that sphere is indeed small in my estimation.

(9) *Uncertainty as to Occurrence of Postoperative Hæmorrhage.*—Not knowing the point of origin of the hæmorrhage, mechanical measures for control are not applicable, and as yet we have no other reliable means by which we can check it.

(10) *Its Inapplicability in Pedunculated Projections.*—While it is generally claimed that the Bottini operation is not indicated in pedunculated projections, Young [22] believes these can be modified by making bilateral cauterizations at the base. That this, however, is an uncertain and indefinite procedure must be apparent to every one, and the danger of completely

amputating the projection, and thus leaving it free in the bladder, is so imminent that there would seem to be no question as to the dangers of this procedure being prohibitive.

(11) *Its Inapplicability in Cases attended with Stricture of the Urethra, and also with Elongated and Narrowed or Distorted Prostatic Urethra.*—These are mechanical obstacles which absolutely prohibit the operation through the urethra while they exist. Unless the conditions are urgent, the first obstacle might be overcome by urethrotomy or divulsion. Newman [23] claimed that the instrument is difficult of introduction, and in many cases of hypertrophy the mechanical conditions rendered it non-introducible. Horwitz [18] concurs in its not being usable in cases with elongated and narrowed prostatic urethræ.

(12) *Its Insufficiency,* in that it does not permit the treatment of other pathologic processes which may exist at the time in the bladder, viz., calculus, ulcer, papilloma, etc.

The twelve objections to the operation which I have referred to apply only to the use of the cautery through the urethra, as all will have noted.

The dangers of sepsis, thrombophlebitis, pulmonary embolism, etc., which have been raised to the operation [12, 20, 24] might apply directly to the effect of the cauterization itself, and would, therefore, attend in some degree all methods of its application. However, as it is the accidents which usually cause the sepsis, etc., an indefinite understanding of the conditions present and the uncertain application of the variable cautery would render these complications more liable of occurrence.

The operation, being wholly in the dark and attended by so many dangers, has been looked upon as a decidedly unsurgical procedure by surgeons generally. It certainly fails to possess those elements of precision and of control which are essentially characteristic of perfect technique. Judging from the statements of the eleven members of this Society who have favored me with replies to my letter of inquiry concerning the Bottini operation, it has been employed by only two general

surgeons in this city. The danger of the operation is well illustrated in these instances, since in twenty-three cases two deaths resulted from accidental incision of the urethra with extravasation and sepsis, and one from uræmia.

It occurred to me in 1895, as it has undoubtedly occurred to others, that if the cauterization was productive of such salutary results as reported by even reliable men, why not apply it from above, through the bladder, and thus obviate all the uncertainties and dangers incident to the urethral route?

I have made diligent search in the literature without finding any reports of the cautery (galvanic or Paquelin) having been employed by this route for the treatment of prostatic hypertrophy, notwithstanding that this would appear to be the natural route. (While preparing this paper, Dr. Murphy has informed me of having used the Paquelin cautery in two instances with unsatisfactory results. I had hoped to present an analysis of Dr. Murphy's cases. Dr. Kreissl also informs me that it has been employed in Vienna and Paris.)

In August, 1900, I had occasion to perform the operation upon a very large man of seventy-six whose urethra was impermeable with the catheter. Upon making a median suprapubic cystotomy, we observed that an immense collar-shaped enlargement of all three lobes projected into the bladder nearly two inches. An incision was made posteriorly and laterally by means of the Paquelin. As it seemed unwise at that time to divide the prostate down to the bladder floor, and as there was a marked cystitis, suprapubic drainage was instituted. There were no ill effects from the operation, and by irrigation and the administration of urinary antiseptics the cystitis was soon controlled and the patient made comfortable, at which time he passed from observation. I understand that several months later he died from some acute complication, the nature of which I have been unable to ascertain. This was a case in which prostatectomy was indicated, but refused. Had we completely divided the collar below and incised it deeply in several radii, as we would now do, the result would undoubtedly have been much better.

In August, 1901, a patient was brought to me at the Monroe Street Hospital, by Dr. Pratt, of Indiana, who was suffering with

complete retention. He was sixty-eight years old, of good habits, and enjoyed fairly good health. He had experienced an increasing difficulty in urination for two years; had to get up two or three times each night of late. Urine came in a small stream and was attended by considerable pain. Four days previously he had taken a few glasses of beer, which brought on an acute urinary obstruction. This was relieved by the use of the catheter by the attending physician, and later by himself, but on the 9th of August this was unsuccessful, and he was brought to Chicago. Examination showed a distended bladder and a copious purulent discharge from the urethra. We succeeded in relieving the retention with the catheter. Rectal examination revealed enlargement of the left and middle lobes of the prostate. Having him in the hospital, where operative measures could be employed promptly if conditions demanded, I decided to attempt reduction of the acute inflammation of the bladder and urethra, if possible, before operating. Absolute rest in bed, urotropin internally, and boric-acid irrigations relieved the urethritis and cystitis markedly. In two weeks I made a suprapubic cystotomy,—utilizing the transverse incision,—having, of course, previously irrigated the bladder. The cut vesical edge was carefully protected, the bladder explored with the finger, and by use of retractors carefully inspected. A distinct bar formation was observed across the urethral orifice and only a slight bulging of the left lateral lobe. The bar was readily destroyed with the ordinary Paquelin point and a shallow groove burned into the left lobe. A No. 12 catheter was inserted, and the bladder wound closed by two rows of carefully applied continuous catgut sutures. The external wound was closed with a small precautionary capillary drain inserted through the abdominal wall, to be removed in seventy-two hours unless leakage occurred.

The subsequent history was absolutely perfect. A catheter was maintained in the urethra for four days and passed frequently for the following few days. The patient was allowed to be propped up in bed in a week. He returned to his home in three weeks without symptoms of obstruction, but with some cystitis. This increased, but the attending physician relieved it in three weeks, and since then the patient has been generally greatly improved. His physician reports that there is no obstruction and no residual urine now. The patient continues to be troubled

some with attacks of cystitis. This was present before the operation, frequently persists after any of the operations, and certainly is no more likely to occur after this operation than after the typical Bottini.

Briefly, the apparent advantages of the suprapubic or transvesical route are as follows:

(1) It admits of an accurate anatomicopathologic diagnosis which is fundamentally essential to intelligent treatment.

(2) The cauterization can be made with the galvanocautery or the more commonly possessed Paquelin cautery with ease, rapidity, and safety. A curved cautery-blade would greatly facilitate the procedure.

(3) The incision can be accurately placed.

(4) We can see the field of operation and the structures being cauterized.

(5) The length and depth of the incision can be regulated to meet the requirements in the particular condition found.

(6) The temperature of the blade is under direct ocular observation.

(7) The time of application can be regulated so as to insure destruction of the tissue, and if the Paquelin is used it can be applied with sufficient force and time to make the incision, regardless of the density of the tissue.

(8) There is no danger from bending of the cautery.

(9) If hæmorrhage does occur, its location can be definitely determined, and measures for its control intelligently and effectively employed, as has been demonstrated by Eisendrath.

(10) It is applicable to all forms of enlargement projecting into the bladder, and particularly so in the removal of pedunculated lobes or valve formations. A partial prostatectomy followed by cauterization would be an ideal procedure for such conditions.

(11) It is applicable in all cases regardless of urethral

obstruction. Such obstructions can frequently be readily removed from within.

(12) It admits of the removal of a calculus or the direct treatment of an ulcer. It also admits of suprapubic drainage if the cystitis seems to require it, or if the urethra is impermeable from within.

(13) It is not as likely to be followed by infection, phlebitis, sepsis, etc., as the uncertain urethral operation.

In short, it is a simple, rational, comparatively safe and satisfactory method of applying the cautery to prostatic enlargements projecting into the bladder. It would seem to bear practically the same relationship to the urethral operation as open herniotomy bears to the old blind method of dividing the constricting ring in strangulated hernia.

With careful operative technique and properly cared for catheter drainage the possibility of the establishment of a fistula is practically eliminated, particularly so when these patients are operated upon early, before secondary changes in the bladder have occurred.

The vesical mucous membrane and wound can be readily protected by compresses under retractors, and the collection of urine can be controlled by sponge compression or the use of the dentist's aspirator.

In contracted bladder this operation would be very difficult, and should, therefore, be avoided. As the Bottini operation is admittedly of no value in such cases, prostatectomy or perineal drainage should be employed if operating at all is determined upon.

This being an operation attended by some shock and considerable pain, a general anæsthetic would, of course, have to be employed. This might be positively contraindicated in some very old, feeble, and nephritically septic patients, and in these the urethral route would probably be indicated. However, in this extreme class of cases, which will rapidly grow smaller since prostatic surgery is now rapidly progressing, simple vasectomy under local anæsthesia offers quite as much encouragement as the Bottini operation.

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TRAUMATIC RUPTURE OF THE SPLEEN; SPLENECTOMY; DEATH ON THE SIXTH DAY.

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THE following case is reported for the purpose of adding another to the already recorded cases of splenectomy for rupture of that organ.

M. W., colored, seventeen years of age, entered Freedmen's Hospital, January 24, 1902, with the following history. About midnight on January 18 she was knocked down and kicked in the left side by her drunken paramour. Thinks that she was unconscious for about ten minutes. She was raised by her assailant and put to bed, being unable to move. Has since suffered severe pain all over abdomen, but worse in left side. Vomited twice on the 19th, and has had more or less nausea ever since. She was nursed by her lover until the 21st, when he left her, saying that he was going for a doctor. He failed to return, and the case coming to the notice of the police, one of the physicians to the poor was sent to see her. He promptly recognized the gravity of the case, and directed her removal to a hospital. I saw her within a few hours after her admission, and found the following conditions. Patient is a rather frail, delicate looking girl. Lies on her back, with knees drawn up. Expression anxious. Pulse, 130; temperature, 102° F.; respirations, 30. Brain and nervous system normal. Some bronchial râles over both lungs. Heart's action rapid and weak. No murmurs. Tongue coated. Abdomen excessively tender to touch. Tenderness most marked over left upper quadrant, but is noted over entire abdomen. Rigidity of upper half of left rectus muscle. In left upper quadrant is an area about four inches in diameter which is perceptibly darker

Traumatic rupture of the spleen.

than the rest of the skin. The same appearance is noted, to a less degree, in both iliac regions. Percussion reveals dulness over the region of the stomach and spleen, tympanites elsewhere. States that bowels have moved daily without evidence of blood. Urine normal. Diagnosis, peritonitis with intra-abdominal hæmatoma and probably rupture of the spleen.

Circumstances beyond my control delayed operation until January 27, the treatment in the meanwhile being the cold coil to the abdomen, the free use of saline purgatives and sufficient morphine to control pain and restlessness. Pulse and temperature continued about as on admission.

Operation, January 27, 1902, Dr. W. A. Warfield assisting. Incision at outer border of left rectus muscle, from free border of ribs to level of umbilicus. When the peritoneum, which was thickened and injected, was opened, old, dark fluid blood flowed out freely. The lower end of the spleen was seen, and showed a distinct rupture. Another incision, joining the first at its upper end, was now made, extending four inches along the lower margin of the ribs. The flap thus made being turned down, the hand was introduced and the spleen palpated. The laceration seen at the end was found to be the termination of a long laceration which ran the entire length of the spleen posteriorly. About twenty ounces of old fluid blood in all escaped, and two double handfuls of clots were turned out. The clots and decomposed blood were mostly behind the stomach and extended as far as the diaphragm. There seemed to be no chance to save the spleen, and its removal was therefore determined upon. The adhesions to the neighboring viscera were tied off and the organ gently delivered through the wound. The pedicle was approached from behind, clamped near the spleen, tied off in two sections with silk, and the spleen cut away. The cavity was washed out with hot salt solution, a drain inserted at the lower angle of the horizontal incision, and the rest of the wound closed. No further exploration of the abdomen was made, as her condition did not warrant extensive or prolonged search, and there was nothing in the history of the case to indicate injury to the abdomen elsewhere. Time of operation, forty-five minutes. At its close the patient was given an enema of hot salt solution, black coffee and brandy, and put to bed with a pulse of 156.

The after treatment may be summed up by saying that it was

actively stimulating. Strychnine, salt solution, digitalis, and alcohol were freely used, with iron for the anæmia. I may say here that the blood examinations showed nothing of interest beyond a pronounced anæmia, the reds being reduced to 2,500,000. The temperature after operation ran between 101° and 102° F. and the pulse between 120 and 140. The wound was examined on the second day and found to have drained freely. No infection. Drain removed. It was dressed again on the fifth day and found to be perfectly dry and free from infection. On the fourth day after operation she began to have cough and annoying accumulation of mucus in the throat. Signs of consolidation were now evident in the upper part of the right lung. From this time there was a gradually increasing weakness, the pulse becoming very feeble in spite of energetic stimulation, and she died quietly early on the morning of February 2.

I am indebted to Dr. L. W. Glazebrook, Deputy Coroner, for the notes of the autopsy. Brain, vessels, and membranes normal. Thorax: beginning hepatization lower lobe of left lung. Right pleura slightly adherent. Red hepatization upper lobe right lung. Heart normal. Abdomen: wound area in good condition. No blood in abdominal cavity. Gangrenous peritonitis, involving chiefly colon and lower portion of ileum. Spleen absent. All other abdominal organs normal, except that they were soft and anæmic.

The peritonitis was probably due to injuries inflicted at the time of the assault and existed before operation. I was, perhaps, at fault in not making a more thorough exploration of the abdomen at the time of operation. In conclusion, I may say that by approaching the pedicle from behind it was easily reached and clamped.

GANGRENOUS INTUSSUSCEPTION IN A CHILD FOUR YEARS OLD; INTESTINAL RESECTION; RECOVERY.

THE VALUE OF END-TO-END SUTURE WITH AN INNER ROW OF STITCHES THROUGH ALL THE LAYERS OF THE INTESTINE AND AN OUTER ROW THROUGH THE OUTER LAYERS.[1]

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Recovery from irreducible intussusception is unusual. In 1897 Gibson (*New York Medical Record*, July 17, 1897) tabulated with great care all the cases of intussusception which he could find recorded in medical literature,—239 in number,—and in this entire list there is no record of recovery from non-reducible intussusception in a patient under seven years of age, and there are only nine such recoveries in older patients.

In a subsequent paper in which he studied the results of 1000 operations for acute intestinal obstruction and gangrenous hernia (Annals of Surgery, October, 1900, p. 497), he considers the operations for intussusception of various grades: 1. Reducible; 2. Irreducible (not septic); 3. Gangrenous; and makes the following statement: "When we encounter the third variety, gangrene of the intussusception, we are confronted with a state so severe as to be almost beyond the hope of relief." "Free extirpation of the intestine is called for, an operation which in these desperate cases is practically

[1] Read before the Surgical Section of the New York Academy of Medicine, December 9, 1901.

always fatal." He found only one case of recovery after resection of gangrenous intussusception.

Braun (*Verhandlungen der deutsche Gesellschaft für Chirurgie,* 1885), studying the subject in 1885, could find no record of cure of non-reducible intussusception either simple or gangrenous.

Clinical History of Patient.

The history of the patient, who was shown before the Surgical Section of the Academy of Medicine in a condition of vigorous health, is as follows:

He had always been well until May 24, 1901, when he began to have abdominal pain and discomfort. He was then four years and four months old. The pain and discomfort continued for ten days, during which time he had no movement of the bowels, although repeated enemata were given. He vomited frequently throughout the time. For five or six days the vomitus had appeared like the contents of the small intestine. He had been losing weight and growing weaker all the time.

Physical Condition.—When seen June 3 he was extremely emaciated; the abdomen was greatly distended, and tympanitic everywhere. There were several irregularly transverse ridges which indicated the position of the distended intestine. No peristalsis was evident. Rectal examination simply showed the distended viscera pressing backward from in front. Pulse, 120; temperature, 100° F.; respiration quiet. The facies indicated weakness, but no acute inflammation.

Operation was advised immediately, and was done at 10 P.M., at St. Mary's Free Hospital for Children. A median incision about four inches long was made below the umbilicus. The abdominal wall was very thin; coils of intestine which were greatly distended rolled out of the incision as soon as it was made; they were congested but not inflamed. An intussusception was found about the middle of the ileum; it was about two and a half inches long. The intestine below this was empty. On gentle manipulation, an opening appeared through the intestinal wall, which was gangrenous at the site of intussusception. The intussusception, two or three inches of intestine at each end of it, and a gangrenous piece of the mesentery were excised. A large

amount of gas escaped from the upper intestinal end; also intestinal contents about the color and consistency of pea soup. After this the coils of intestine which had been so greatly distended, and which had been kept in hot moist towels, could be returned into the abdomen. The intestine about the excised portion was washed repeatedly in warm saline solution. A circular enterorrhaphy was then done. The first row of stitches passed through all the layers of the intestine and brought the peritoneal surfaces into close apposition at the margin. At the mesenteric border they were so placed as to obliterate the dead space there and hold broad peritoneal surfaces together, well supported by intestinal wall. A second row of Cushing stitches was then taken outside of this, and this was in certain places reinforced by a third tier of similar stitches. The intestine was then returned into the abdomen, and thorough irrigation with hot saline solution given. The abdominal incision was closed with tier sutures. Intravenous infusion of hot saline solution, one and a half pints, was given, and the patient put to bed in fairly good condition.

The bowels moved on the next morning, and recovery was uneventful, excepting for a small mural abscess. The child ate ravenously, gained strength rapidly, was out of bed in four weeks, and two weeks later went home. He has continued well ever since.

Consideration of Symptoms.

The clinical picture which this child presented was so striking that I venture to call attention to it again. He showed in a most exaggerated degree the symptoms of prolonged intestinal obstruction, viz., constipation, persistent vomiting of intestinal contents, tympanites, emaciation, the retention of a good temperature, and a fairly good pulse.

He had not had a passage from the bowels in ten days. He had repeatedly vomited material from the intestine, thin, grayish, containing small particles of partially digested food. Tympanites was excessive, so that there were ridges across the abdomen which indicated the position of the distended coils of intestine. He had become so emaciated that his appearance suggested the famine pictures from India. Yet in spite of these exaggerated symptoms there was only moderate

constitutional depression. On the very day of the operation, he had asked for peanuts, and had eaten them; he did not stay in one bed all the time, but went from bed to couch. His temperature was only 100° F. and his pulse-rate 120, —not unduly rapid for so young a child,—and it had been less frequent until that day. He was really suffering from starvation and intestinal distention, the effects of the mechanical obstruction of the intestine, and the picture which he presented was a most vivid one.

Of course there is the gravest possible danger when the symptoms have reached this exaggerated state. It is remarkable that perforation of the intestine had not occurred. In a similar case which I have since seen, in whom operation was refused, a fatal perforation occurred on the sixth day.

Method of Caring for the Gangrenous Intestine.

This case suggests several topics which are important in the management of irreducible intussusception. I will, however, ask your attention to only two:

I. Intestinal Resection *versus* the Making of an Artificial Anus.

II. The Method of Uniting the Ends of the Resected Intestine.

Intestinal Resection versus *Artificial Anus.*—The formation of artificial ani is fast losing favor, and is not to be recommended in the treatment of intussusception. One can imagine cases of dire urgency in which it would be permissible; but they must be very rare; for the diseased intestine in intussusception is not adherent in an opening in the abdominal wall as it sometimes is in strangulated hernia, and it takes almost as long to fasten the divided intestinal ends into the abdominal opening as to fasten them to each other.

Recovery after intestinal resection is usually complete. Recovery after the formation of artificial anus is protracted. The patient is left in an uncomfortable and even precarious condition. Unless the opening is in the lower part of the intestine, life is maintained with difficulty; and even then there is

an irritating and disagreeable discharge and the necessity of a secondary operation or other surgical procedure.

In the six secondary operations for artificial anus after intussusception which are recorded in Gibson's statistics there were three deaths (50 per cent.); and other reports of operation for the relief of artificial anus indicate a high mortality rate. The most favorable results have probably been obtained by resecting the portion of intestine in which the opening exists and uniting the divided ends. By this method Delore and Patel (*Centralblatt für Chirurgie,* 1901, p. 1107) record thirteen cases with two deaths (15.4 per cent. mortality). If this is to be done, it is manifestly desirable to do it at the time of the original operation. The conditions for doing it are not likely to be improved by delay.

The relative advantages of intestinal resection and the making of artificial ani have recently been considered with great care by Peterson (*Centralblatt für Chirurgie,* 1893, p. 62) in a report upon the cases of gangrenous hernia in Czerny's clinic in Heidelberg, 1877-1900. He reports a mortality of 67 per cent. in twenty-two cases in whom artificial ani were formed, while the mortality was 33 per cent. in twenty-eight cases treated by intestinal resection. He also quotes the following statistics:

ARTIFICIAL ANUS.

Mikulicz	94 cases, mortality	72 = 76.6	per cent.
Hofmeister	167 cases, mortality	101 = 60.5	per cent.

RESECTION.

Mikulicz	68 cases, mortality	32 = 47.1	per cent.
Hofmeister	214 cases, mortality	99 = 46	per cent.

Zeidler grouped 269 cases of resection and 213 cases of artificial anus, and studied all obtainable histories in order to determine whether the greater mortality in the latter could be due to their condition before operation; he found that it seemed due to conditions dependent on operation and not to conditions prior to operation. He suggests the probability that an additional 17 per cent. of the artificial anus cases could

have been saved if intestinal resection had been practised. His table is as follows:

	Intestinal Resection	Artificial Anus.
Number of cases	269	213
Fatal cases	122	139
The mortality rate is thus recorded:		
(*a*) Accidental cases	6.32 per cent.	3.76 per cent.
(*b*) Collapse and peritonitis which existed before the operation	19.33 per cent.	24.88 per cent.
(*c*) Secondary peritonitis and infection	15.95 per cent.	20.66 per cent.
(*d*) Other complications accompanying the operation (narrowing of intestinal lumen, exhaustion, inanition)..	2.60 per cent.	11.77 per cent.
(*e*) Result of secondary operation	1.11 per cent.	4.22 per cent.
1. Independent of operation (Groups *a* and *b*).....	25.65 per cent.	28.64 per cent.
2. Following operation (Groups *c*, *d*, and *e*).....	19.66 per cent.	36.62 per cent.

In consideration of these reports, many of them made before intestinal resection was practised as successfully as it is now, one hardly feels justified in making an artificial anus in gangrenous intussusception.

Method of Uniting the Ends of the Resected Intestine.—There are many methods of uniting the ends of the resected intestine. The vast amount of work which has been done on the subject is indicated in the careful review which von Frey (*Beiträge zur klinischen Chirurgie*, 1895) published in 1895, in which he described eighty-one different methods. Since then others have been added to the list.

In the earlier cases the edges of ruptured or resected intestine were brought together without special reference to the approximation of the serous surfaces; stitches were brought through the opening in the abdominal wall, and, if the case recovered, more or less leakage and a temporary or permanent fæcal fistula were expected.

In 1826 Lembert ("Répertoire Général d'Anatomie et de Physiologie," Path. et de Clin. Chir., Tome II, First Part, p. 100, Paris, 1826) enunciated the principle that serous surfaces should be brought together in order to obtain rapid and firm union, and devised a method of suture to accomplish this. This suture, which is known by his name, is still in general use, and the importance of bringing the serous surfaces together is universally recognized.

The term "Lembert suture" is frequently applied to any form of suture which brings the serous surfaces together without penetrating the mucous membrane, but it is perhaps better to apply it to the interrupted suture which he described. His needle penetrated the serous and muscular layers and passed between the muscular and mucous layers. He did not refer to the submucous layer; but the stitch as he used it must have frequently included it. In certain instances he stated that it even penetrated the mucous membrane. Halsted (*American Journal of the Medical Sciences,* October, 1887; *Johns Hopkins Hospital Bulletin,* January, 1891) has particularly called attention to the importance of including the submucous layer in the stitch, as the fibrous structure of this layer prevents the tearing out of the thread.

It is not necessary at this time to describe in detail the numerous methods of suture which have been devised. The articles of von Frey and Senn (*Journal of the American Medical Association,* August 12, 1893) may be referred to for these descriptions.

Exquisite ingenuity has been shown in the invention of artificial aids either to hold the intestine together or to form a support while stitches were being placed. The Murphy button, the one of these aids which is in most general use, is easily and quickly applied, and gives in most instances a firm and satisfactory union. Its use has greatly reduced the mortality rate. The mortality was 19 per cent. in 750 cases of entero-enterostomy collected by one of Murphy's assistants and reported by Murphy (*Philadelphia Medical Journal,* 1900, p. 1271) at the American Medical Association in 1900, or 14.4 per cent.

in the non-malignant cases. The great majority of surgeons prefer its use to all other methods of uniting the ends of resected intestine.

There are, however, certain conditions in which its use is impracticable or inconvenient; for instance, in this case the intestine above the intussusception had been greatly distended for several days; its diameter was about two and a half inches. The difficulty of fitting its end to a seven-eighths inch Murphy button would be greater than the difficulty of doing an end-to-end suture, and a Murphy button seven-eighths inch in diameter is a close fit for the ileum of a child of four; it distends it considerably in the cadaver of such a child.

Again, these are operations of emergency, and there are many instances where the proper sized button—or, in fact, any other artificial appliance—is not at hand. Then there are advantages in avoiding the leaving of a large foreign body with a small lumen in the intestine. There will always be use for a simple and secure method of end-to-end suture with no artificial aid but thread and needle. I say *end-to-end* suture because, in those parts of the intestine which have a mesentery, it is simpler than lateral anastomosis or lateral implantation, and gives less likelihood of cicatricial stenosis.

There are numerous methods of end-to-end suture; of these the Czerny-Lembert suture has probably been the one most generally used,—a row of inner sutures uniting the mucous membrane, and a row of Lembert sutures outside of this. The difficulties in its use are: (1) The mucous membrane tends to evert so that mucous surfaces are brought together. These will not unite quickly, and hence the integrity depends upon the external row of Lembert sutures. (2) The mesenteric border is a particularly weak spot. The strip of intestinal wall which is left uncovered by peritoneum here is usually a little more than one-fourth inch wide, and the union of the mucous surfaces cannot be relied upon to prevent leakage at this point, nor can the thin layers of peritoneum be relied upon to retain the material which leaks through the intestinal wall.

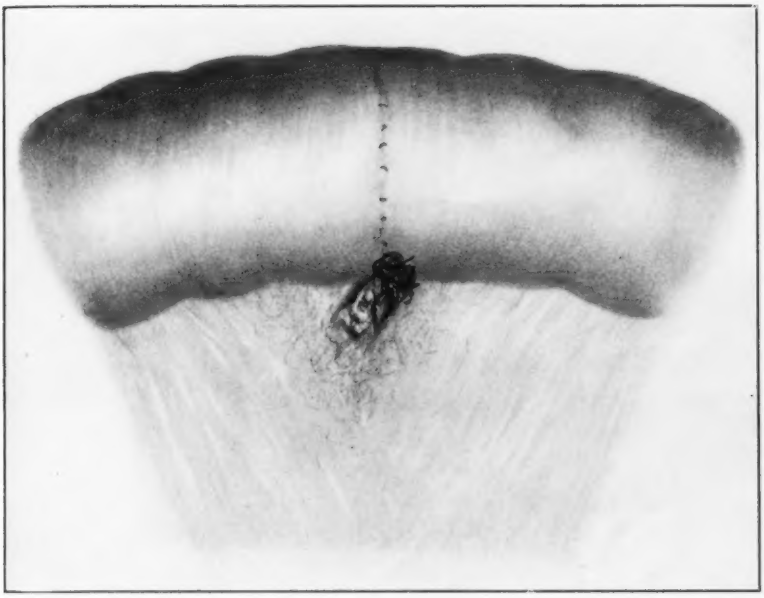

FIG. 1.—Intestine united by modified Czerny-Lembert suture, showing (1) the firm union which had formed in most of the suture line within twenty hours; (2) perforation and leakage at the mesenteric border.

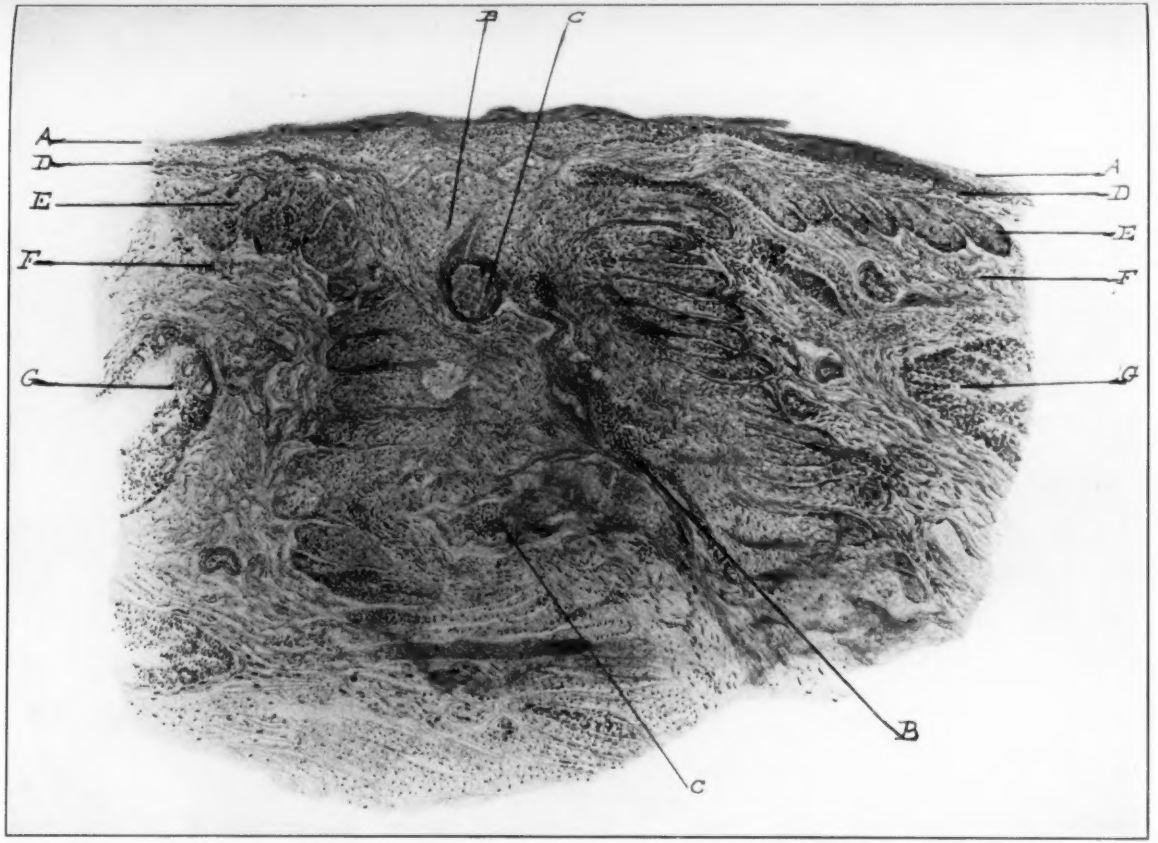

FIG. 2.—Microscopical picture of a longitudinal section of sutured intestine showing firmness of peritoneal exudate twenty hours after operation. A. Peritoneal cover of intestine. B. Peritoneal exudate filling space between surfaces of inverted intestines. C. Section of silk suture. D. Longitudinal muscular layer of intestine. E. Circular muscular layer of intestine. F. Submuscular layer of intestine. G. Mucous membrane.

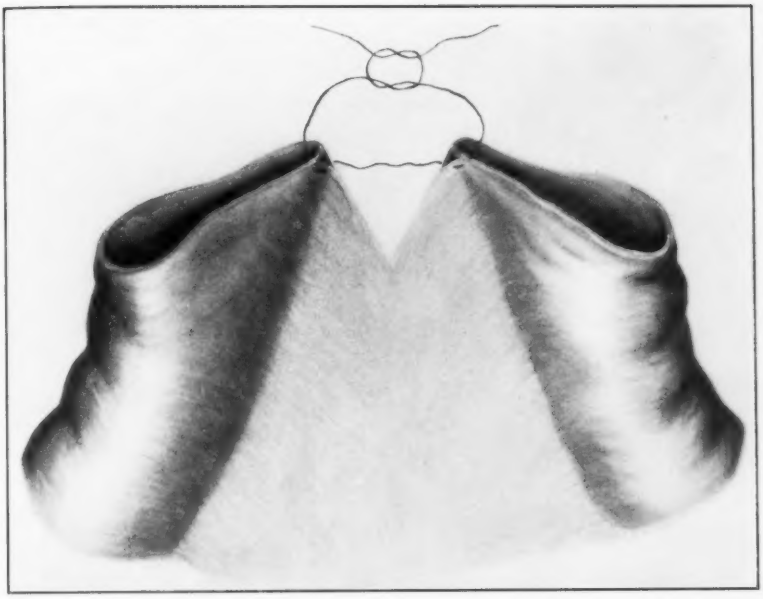

FIG. 3.—First stitch, taken through all the layers of the intestinal wall, and through both the layers of the peritoneum which are reflected from the intestinal wall to form the mesentery. A similar stitch is at once taken through the intestinal wall on each side of this one to strengthen the union at this place.

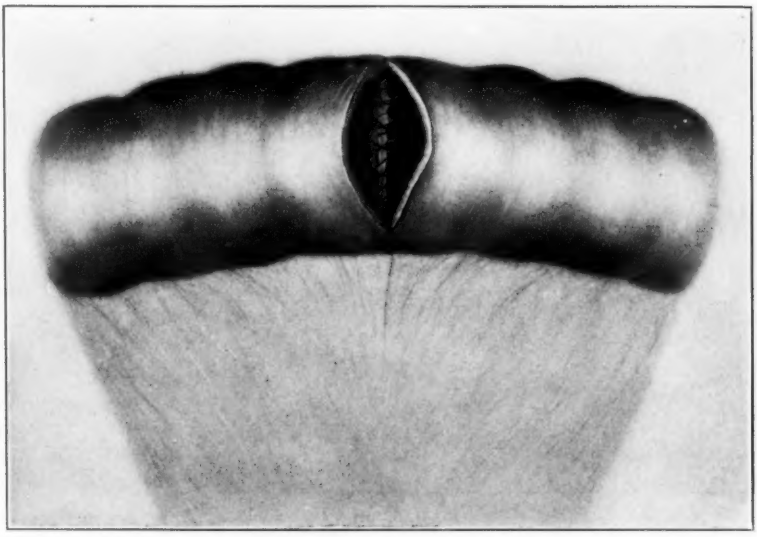

FIG. 4.—Appearance of the intestine when two-thirds of the first row of stitches have been taken.

Some time ago a specimen came into my possession which is most instructive in the study of intestinal repair. It was taken from a patient upon whom another surgeon had done a Czerny-Lembert end-to-end suture for gangrenous hernia on the preceding day. He had, however, taken continuous instead of interrupted sutures. The patient died twenty hours later. This specimen, which is here figured (Figs. 1 and 2), shows, first, the remarkable union of peritoneal surfaces which had taken place in so short a time in most of the suture line. Second, the leakage at the mesenteric border. Any one studying it must appreciate the importance of so arranging intestinal sutures that they will hold the serous surfaces firmly together and give them the support of the stronger portions of the intestinal wall; the peritoneal exudate quickly seals the line of union, and if there is a firm support pressing the layers of the intestine against it, leakage is impossible and a strong union soon follows.

Can we put our sutures through the entire intestinal wall in order to gain this firm support? This seems to me the most important question concerning intestinal sutures at the present time, and the answer should be, Yes.

In order to call attention to the desirability of using these through and through stitches, and re-enforcing them by an outer row of superficial stitches, the method which was used in this case is here figured.

The first stitch was taken at the mesenteric border: it passed through the entire intestinal wall and through both layers of the peritoneum as they pass from the intestinal wall to form the mesentery (Fig. 3). When it was tied, the peritoneal surfaces were in close apposition and had the support of the entire thickness of the intestinal wall. A stitch was at once taken on each side of this to strengthen the union, and then a row of stitches about the entire circumference of the intestine, entering the mucous membrane one-eighth or three-sixteenths inch from the cut margin and emerging from the serous coat, then entering the serous coat of the other intestinal end at a corresponding place, and emerging from the mucous membrane. These stitches passed over the inverted edge of the intestine and were tied there. A knot was made after every third insertion of the needle (Fig. 4). These knots were formed by tying the free end of the thread,

which was left protruding from the stitch-hole, with the double thread which emerged from the other side of this hole. If one of the threads leading from this knot is left uncut, the stitching may be continued with the same needle and thread.

There is no difficulty in inserting these stitches without especial appliances; mouse-tooth forceps, sewing silk, and needle are all the appliances needed. While the stitches are being placed, the edges of the intestine may be held taut with the mouse-tooth forceps or a silk thread. The manner of inserting the last stitch is shown in Fig. 5. After its insertion, the stitches need in no place be more than one-eighth inch apart, and the peritoneal surfaces are in firm apposition throughout the entire circumference of the intestine.

This row of stitches was then re-enforced by an outer row (Fig. 6) of Cushing sutures which included the serous, muscular, and submucous layers, and which were knotted after every third or fourth insertion of the needle.

This method, although worked out independently, possesses the essential elements of the method of Frank (von Frey, *loc. cit.*), viz., an inner row of stitches through all the intestinal coats and an outer row of superficial stitches. Many of the knots of his inner row of stitches, however, are left on the serous side; a real disadvantage, as they increase the danger of abscess formation there. The stitches of his outer row are also taken by a less rapid method than Cushing's.

The method described by Lilienthal in his excellent book on "Imperative Surgery" also has the same essential features; but the stitches of his inner row are only six or eight in number, are interrupted, and are called "anchor sutures." Their purpose is "to draw the cut ends of the intestine together," not to make a firm apposition of the peritoneal surfaces about the entire circumference of the cut intestine. The main dependence must therefore be placed upon the second row of stitches, which are accordingly made with a separate thread for each stitch, a much slower method than Cushing's.

There is certainly an increasing tendency to take certain stitches through the entire intestinal wall, and the advocating

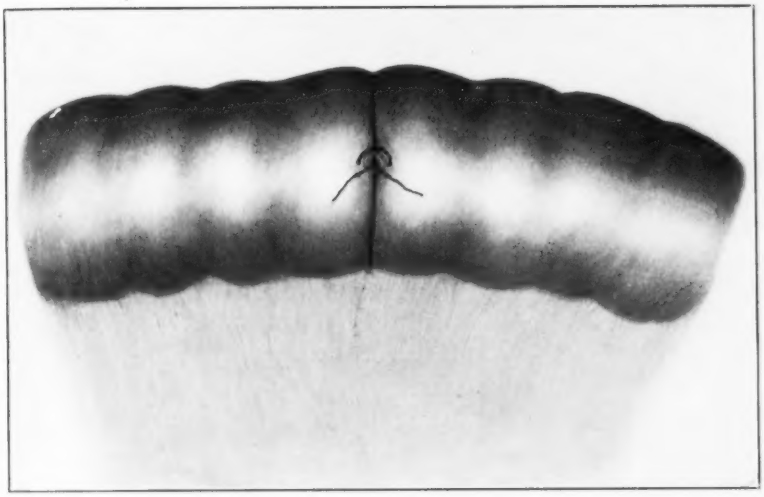

FIG. 5.—Last stitch of the first row; ends to be pushed into the lumen of the intestine after knot is tied.

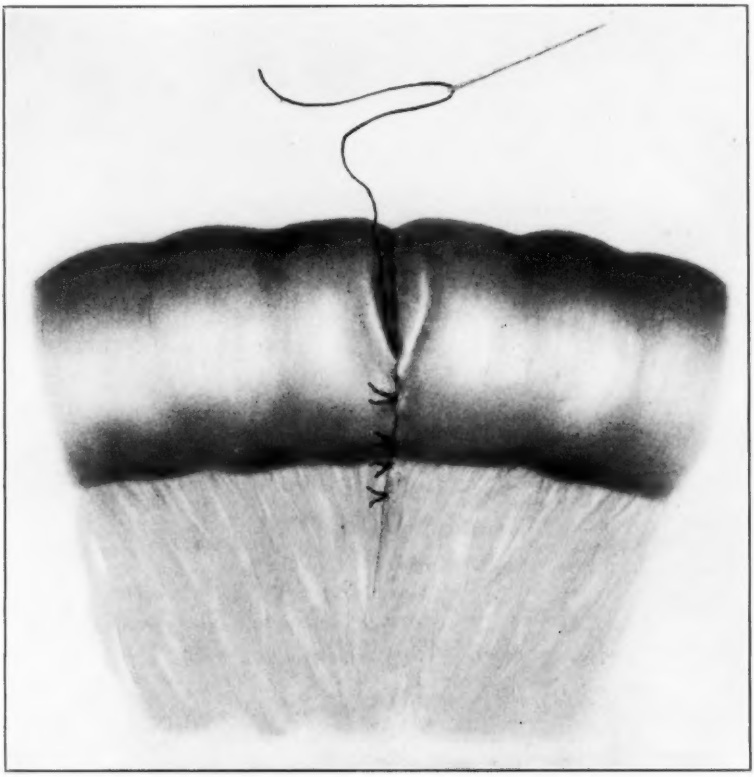

FIG. 6.—Second row of stitches taken by Cushing's method, knotted after every third or fourth insertion of the needle.

of such stitches by Lilienthal and Frank is of much importance in the development of the subject.

The results of other methods in which through and through stitches are used also bear on the subject and should be given. Maunsell (*American Journal of the Medical Sciences,* March, 1892) depended on a single row of such stitches so placed as to bring the peritoneal surfaces at the margin in firm apposition. In thirty-one reported cases in which this method was used there were only three deaths. Some of the operators, however, did not depend entirely on this single row of stitches, but re-enforced them by a second row of superficial stitches. M. E. Connell (*New York Medical Record,* September 17, 1892) has used a continuous through and through stitch which brings the peritoneal surfaces together at the margin of the cut intestine, and F. G. Connell (*Journal of the American Medical Association,* October 12, 1901) and Bishop (*Medical Chronicle,* September, 1885) have devised a similar method in which interrupted stitches are substituted for the continuous one. No re-enforcing stitches are used in either of these methods; yet a report of nineteen cases in which they were used gives only four deaths, and of these four three were reported as due to shock; the fourth occurred eight days after operation, and the autopsy showed the line of suture intact.

In operations on animals this method gave 100 per cent. recovery, or 97 per cent. recovery done in the hands of graduate students.

Taking into consideration all the possibilities of error in statistics which are taken from various operators instead of from a single institution, we may feel that the results are favorable to the use of through and through stitches. Most surgeons, however, do not feel it safe to leave such a row of stitches without re-enforcing them by a second row of superficial ones. When so re-enforced, any infection which might follow the stitch is much more likely to work its way into the lumen of the intestine along the thread than to push the peritoneal adhesions apart and force its way into the peritoneum. We have, in fact, after the application of such stitches, the

conditions which, according to Edmunds and Balance (*Medico-Chirurgical Transactions,* lxxix, p. 254), exist after the application of Lembert sutures; for they found in autopsy examinations on a man and on dogs, which were made two or three weeks after the application of Lembert stitches, that the stitches were working into the lumen of the intestine, and were hanging, partly inside the intestine, partly in the intestinal wall. Yet we would not think that these stitches were likely to cause peritonitis. The infection would naturally follow the course of least resistance—towards the intestinal lumen.

There can be no question but the lumen of the intestine is frequently entered in taking stitches designed to include nothing below the submucous layer. The submucous layer is about one-two-hundredths of an inch in thickness; and it is manifestly impossible to insert a needle through the muscular coating and include this layer alone without occasionally piercing the mucous layer. Yet this seldom does any harm, even though the knot is on the outside instead of on the inside.

The time consumed in applying these two rows of stitches differs little from that required for the application of a Murphy button. The suturing can be completed in ten minutes; in fifteen minutes it can be done without hurrying.

One may ask whether this double row of stitches produces a diaphragm and consequent constriction within the intestine. The experiments of Edmunds and Balance answer this question in a most satisfactory manner. They used various methods of intestinal union to determine the amount of diaphragm formation or cicatricial contraction which results, and found that the Maunsell suture, re-enforced by the Lembert suture, gave practically no diaphragm. This method gives the same conditions as the Maunsell method, with the re-enforced row of Lembert sutures, the only difference being that the inner row of stitches is applied without making the longitudinal cut in the intestine or invaginating one intestinal end into the other. Hence, we need have no fear of diaphragm formation. The vascularity is so great that the blood supply is not cut off; the tissues about the stitches retain their pinkish color.

THE OPERATIVE TREATMENT OF DISEASES OF THE PANCREAS.[1]

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THE surgical treatment of pancreatic disease may be divided thus: first, operations performed on the gland itself; second, those performed on some outgrowth or fluid exudate starting from the gland, and, third, those performed on some adjoining viscus or viscera for the relief of secondary conditions following disease of the pancreas. Operations upon the gland itself are seldom performed. The deep location of the organ, its immobility, and its close proximity to very important structures make such operations most difficult and dangerous. The conditions which may call for operations of this kind are tumors or cysts situated in the substance of the gland, a concretion in the pancreatic duct, or an abscesss localized within the pancreas. Incision of the gland itself, enucleation of a tumor or partial removal are all difficult and bloody, whereas complete extirpation is not allowable both from anatomical and physiological reasons. Operations on some outgrowth or fluid exudate coming from the gland are much more frequently performed and the difficulties are vastly less. The conditions included in this category are mostly cysts, peripancreatic abscess, hæmorrhage from the pancreas, etc. Although the latter is the starting-point, a cyst or collection of blood or pus pushes its way towards the anterior or posterior surface of the body, and thus becomes more easy to attack.

[1] Read before the New York Surgical Society, February 12, 1902.

It forms relations with other viscera which are much simpler to deal with than if it had remained confined to the immediate vicinity of the pancreas. A cyst, for example, grows forward between the stomach and transverse colon, and can finally be reached very easily by an anterior abdominal incision and division of the gastrocolic omentum. In the same way an abscess starting from the pancreas may work its way to the surface at some distance from this organ. Operations of the third class, viz., those performed on some adjoining viscus for the relief of secondary conditions, include cholecystotomy, cholecystenterostomy, cholecystogastrostomy for drainage of the distended gall-bladder and ducts in case of enlargement of the head, and rarely gastro-enterostomy on account of compression of the duodenum.

The lesions of the pancreas which are most frequently the object of surgical interference are cysts; acute and subacute inflammations including the necrotic and suppurative forms, chronic interstitial inflammation; and solid tumors.

The records of the New York Hospital show that during the past ten years there have been under treatment fifteen cases of pancreatic disease. These may be classified as follows: Cysts of the pancreas, eight cases; acute hæmorrhagic pancreatitis, three cases; suppurative pancreatitis, one case; chronic pancreatitis, one case; carcinoma of pancreas, two cases. This list makes cysts of the pancreas much more common than any of the other lesions, and thus corresponds to the usual reports. It should be borne in mind, however, that cysts of the pancreas are much the most easy to diagnose, and hence comparatively few cases escape detection. On the other hand, the remaining conditions are often impossible to detect, and many cases die without a diagnosis having been made. This is true, for example, of acute pancreatitis; but, now that the attention of surgeons as well as physicians is directed particularly towards this disease, the number of cases recognized will increase.

Cysts of the pancreas have only been the object of oper-

ative treatment since 1882, when Gussenbauer was the first to diagnose one and treat it successfully by incision and drainage. Since that time the number of published cases has increased considerably from year to year, but it still belongs to the rare conditions met with in surgery. In 1893 I collected from the literature fifteen cases where the diagnosis had been made and operation performed, and in 1898 Körte found that the number of cases operated upon had increased to 121. With this increase in the number of cases treated there has been a corresponding addition to our knowledge of the pathology and the anatomical conditions associated with the development of cysts of this organ. The different varieties of cysts depending upon their etiology present much the same features, and the operative measures are practically the same in all kinds. It has been found that in the majority of cases the cyst grows forward from the pancreas, pushing the peritoneum before it and emerging between the stomach and the transverse colon. It is thus covered by the two layers of the great omentum and the posterior peritoneal layer of the lesser cavity. In case of large cysts the stomach and colon may be widely separated. At times the stomach covers considerable of the anterior surface of the cyst, while the colon may be pushed down nearly to the symphysis. Instead of appearing between the stomach and colon, the cyst may grow forward between the liver and stomach, thus being covered by the small omentum. The anterior wall of the cyst may in this case be partially covered by the liver and stomach. In a third class of cases the cyst may grow between the layers of the transverse mesocolon and push forward either the upper or the lower layer. If the former occurs, the tumor lies, as in the first case, below the stomach and is crossed by the transverse colon. If the lower layer of the mesocolon is pushed forward, the cyst appears *below* the transverse colon and its lower border may extend down to the pelvis. Fortunately for the diagnosis, the cyst has in the majority of instances a characteristic location between the stomach and transverse colon, which can be made still more evident by artificial distention of

these viscera. There is usually a zone of tympanitic percussion between the tumor and the liver. The location of the abdominal swelling and its relations to other organs are our chief means of making the diagnosis. Glycosuria, fatty stools, and undigested muscular fibres in the stools are all inconstant symptoms, and are much more frequently absent than present. The tumor may appear suddenly or gradually.

The relations of the tumor with the stomach and the colon determine the mode of attacking the cyst. It is evident that the possibility that the cyst is partially covered by the stomach or colon makes simple puncture without laparotomy a dangerous procedure on account of possible injury to these organs. In fact, the therapeutic value of aspiration is very doubtful. In almost every instance in which it has been tried the cyst has reappeared soon after. As a diagnostic measure it may be useful, but should be condemned on account of the danger. The operation which Gussenbauer was the first to perform in 1882 is incision and drainage of the cyst. The abdominal cavity is opened by a vertical incision over the tumor. In most cases this will mean an incision in the median line or through one of the recti and above the umbilicus. Those cysts which push forward the lower layer of the transverse mesocolon may have to be exposed by an incision below the navel. After opening the peritoneal cavity the cyst may be found to be more or less completely covered by the stomach or colon. If this is the case, it may be necessary to displace one or the other so as to expose sufficiently the front of the cyst. Palpation will reveal the fluid character of the tumor, and an exploratory puncture may now be done to make the diagnosis certain or to relieve the tension within the cyst. The next step in the operation consists in suturing the cyst, or rather its peritoneal covering into the wound, with catgut sutures. If this is difficult, owing to the thinness of its wall or to insufficient space, gauze packing about the circumference of the opening may be substituted. The question of immediate or subsequent opening of the cyst has next to be decided, and opinions differ as to which method is preferable. In case

there is no urgent need, such as from pressure symptoms or cachexia, it would seem desirable to wait for adhesions to form with the abdominal wall and then open the cyst a few days later.

After evacuation of the cyst contents by incision or the thermocautery, a drainage tube or gauze packing is inserted and a voluminous dressing applied. Care should be taken to protect the neighboring skin from the prolonged irritation of the discharge. The latter, owing to the ferments contained in it, has a digestive action upon the parts about the fistula, and may lead to troublesome inflammation. Zinc oxide and starch ointment or zinc plaster will avoid this complication. The fistula resulting from the opening of the cyst takes a variable time to close. In some instances it has remained open for two years and then finally healed. Six months is not an unusually long time for it to persist. In three cases reported by A. B. Johnson the fistulæ remained open six months, eight months, and two years. The presence of this fistula is only of slight consequence, and need not interfere with the patient being out of bed. Hernia at this point is possible, but very rarely reported. The results of this form of operation are extremely favorable. Boeckel has recently given these figures. The number of cases operated upon by incision and drainage was 115. In ninety-nine of these the cyst was opened at the first sitting, with the result that ninety-two recovered and seven died. In sixteen cases the cyst was opened subsequently, after the formation of adhesions, with sixteen recoveries and no deaths. Provided the correct diagnosis can be made before operation and the relations of the cyst are not of a complicated character with reference to the other viscera, incision and drainage should be followed by eventual recovery.

Extirpation of the cyst is of course a more ideal operation, both for the reason that it requires less time for healing and avoids all possibility of recurrence, but this is feasible only in exceptional cases. The operation is necessarily a very bloody one, the excretory duct may be wounded, important

vessels may require ligation followed possibly by gangrene of intestine, and it may be difficult or impossible to obtain a pedicle. It is very rare to find the cyst well encapsulated, so that it can be enucleated without interfering with the substance of the gland. Cysts confined to the tail of the organ are the best adapted to extirpation, chiefly because this portion is much more movable than the other end, and thus the necessary manipulations are facilitated. Removal through a posterior incision has been tried, but is a most difficult and dangerous procedure. Partial removal has sometimes been done, the part of the cyst left behind being sutured into the abdominal incision and the broad opening packed. In general the difficulties which beset any form of removal of the cyst will deter the surgeon from attempting it except under the most favorable conditions. Of twenty-five complete or partial extirpations collected by Boeckel, four died.

As regards the final results of the usual operation, viz., incision and drainage, a complete cure is the rule, and in no case has the fistula been a permanent one. In rare instances recurrence has followed. This probably indicates the formation of a new cyst, as in a case reported by Richardson. The indications for operation are clearly defined. It should be resorted to in every case provided the patient's condition permits of it. Without operation, the tumor may gradually increase in size, causing pressure symptoms; and there is progressive deterioration of health as the function of the glandular elements of the pancreas is more and more impaired. Extreme emaciation as well as diabetes have been observed in the cases of long duration. A spontaneous cure never occurs, although it may be possible for the swelling to diminish markedly in size and then grow larger as the cystic fluid recollects.

Out of eight cases that have occurred at the New York Hospital during the past decade, operative treatment was employed in seven. Of these one died a few days after the operation from sepsis and another seven months later. In the latter instance the patient had left the hospital with a fistula of six months' duration, and returned a month later

with a very much distended abdomen, which proved to be caused by a carcinoma of the pancreas with nodular enlargements and fluid in the peritoneal cavity. The fistula was still present. In four of the cases the operation was done at two sittings and three at one sitting. The three cases in which the operation was done at one sitting all recovered. In one case the tumor grew forward above the stomach instead of between the stomach and transverse colon. Six of the eight cases occurred in individuals under forty-five years of age and five were women. In one case only, fat was found in the stools, and in none was there diabetes.

Turning to the inflammations of the pancreas, we find that surgical interference is now being brought into use for the relief of conditions which have been hitherto considered hopeless. There will still remain very acute forms of pancreatitis which are necessarily fatal at an early stage; but the subacute stage of these acute cases, moreover those which are subacute from the start and the chronic forms, are all susceptible of operative treatment and cure.

A great deal of interest has been taken of late in acute pancreatitis, and since the classical studies of Fitz many contributions have been made to its pathology and symptomatology. It will be impossible to go into the pathology of this interesting disease in such a paper as this. Suffice it to say that we have to deal either with an inflammation propagated from a neighboring organ such as the duodenum or bile ducts or through the blood. Predisposing factors are alcoholism, cholelithiasis, obesity, etc.

The disease may be either hæmorrhagic, necrotic, or suppurative. The former may be a primary stage of the other two. At other times the inflammation is suppurative from the start. Clinically, it is convenient to divide these inflammations into the acute and the subacute, depending chiefly upon the severity of the onset of the symptoms. An acute inflammation, in case it does not prove fatal as such, may pass into the subacute stage and run a more or less protracted course. Other inflammations have a more gradual and less severe

onset and can be designated as subacute from the start. The symptoms of the cases with an acute onset are well illustrated by the following typical case which recently came under my observation.

A man forty-five years of age was admitted to Bellevue Hospital with a history of a sudden attack, two days previous, of vomiting and intense pain in the epigastrium. A marked alcoholic history was obtained and the patient was very obese. When admitted, the temperature was 103° F., the pulse very rapid; there was marked distention and considerable prostration. The bowels were completely constipated and vomiting was frequent.

A diagnosis was not made; but as the patient's condition seemed hopeless without interference, an exploratory laparotomy was performed the day after admission. Upon opening the peritoneal cavity to the right of the median line below the umbilicus, considerable bloody serum escaped. The intestines were somewhat distended, but no obstruction could be found. The patient's condition making further exploration impossible, a distended coil of large intestine was sutured into the wound and an opening made into the bowel. The patient did not respond to stimulation and died six hours later. The autopsy revealed an acute hæmorrhagic pancreatitis with areas of fat necrosis scattered throughout the abdominal cavity, but most abundant in the vicinity of the pancreas. The pancreas was moderately enlarged, streaked with blood, and showed signs of beginning necrosis. The intestines were uniformly distended, and there was considerable free bloody serum. The amount of fat within the abdomen was excessive.

The manifestations of acute pancreatitis with hæmorrhage or necrosis are those of an acute peritonitis beginning in the epigastrium, and the diagnosis is usually very much in doubt. The symptoms may very closely resemble perforation of the stomach, and later on the intestinal paralysis may be the most prominent factor, thus justifying the diagnosis of acute intestinal obstruction. The disease is likely to end fatally from the second to the fifth day.

The shock and collapse which accompany the onset of the disease may be such as to render any operative interference

out of the question. The chief indications are, then, to overcome the great depression, relieve the intense pain by morphine, and induce a movement of the bowels by enemata. It seems right, however, that an exploratory incision in the epigastrium should be made at the earliest possible moment, *i.e.*, as soon as the patient's condition justifies it. While in some cases not much can be gained by such an opening, owing to the severity of the constitutional manifestations, in other cases evacuation of the bloody serous exudate usually found in the peritoneal cavity and drainage of the upper part of the cavity may turn the tide in favor of the patient. At other times the operation may in case of active hæmorrhage from the pancreas prove directly life-saving, in that it permits of gauze being packed down on to the pancreas and the bleeding arrested. Should the patient survive the primary shock of the attack, and the acute process in the gland go on to necrosis or suppuration, the gauze packing will prove a safeguard and allow the earliest possible drainage of the necrotic or suppurating area. Most cases in the past have been operated upon under a false diagnosis, and often as a last resort. The diagnosis of these acute cases, it is true, is difficult, but will be made more often in the future, and we may then hope that the treatment by early incision and drainage may save certain cases which otherwise would die, as in the past, from hæmorrhage or subsequent sepsis. Spontaneous recovery does, it is true, occur, but only in exceptional cases, and in these the exploratory incision does no harm. Chiari has reported a case where the gangrenous pancreas was evacuated per rectum with recovery, and there are not a few instances where abscesses have emptied themselves into the stomach or intestine. This always implies a subacute stage of the process, in which recovery is much more possible than in the acute. The presence of cicatrices in the pancreas found on autopsy tend to show that mild cases of acute pancreatitis may recover without interference and without subsequent complete necrosis of the organ. Such cases, however, probably give only indefinite symptoms during life.

The exploratory incision which is made at the earliest time consistent with the welfare of the patient can be done under local anæsthesia, and need be only large enough to permit of palpation of the pancreas, exclusion of perforation of a viscus, and insertion of a gauze drain. Should the condition of the patient permit of it, general anæsthesia and more satisfactory exploration will of course be adopted. Upon opening the abdomen, search should be made for areas of fat necrosis which, if found, will tend to confirm the diagnosis of a pancreatic lesion. The escape of bloody serum is also the rule. The two conditions which most resemble acute pancreatitis are perforation of a gastric or of a duodenal ulcer. The history will here, however, be of help, and furthermore the tenderness, particularly in perforated gastric ulcer, is more severe and very intense even on light pressure over the epigastrium. Rigidity of the abdominal muscles is also more marked in perforation. As these perforative conditions also demand exploration, the indications for operation in all cases pointing to acute epigastric peritonitis seem well defined.

The mortality of acute pancreatitis is, as might be expected, very high. Out of twenty-three cases collected by Boeckel, eighteen died. Leaving out of account certain cases in which the patient necessarily succumbs to the primary shock, whether operated upon or not, there are undoubtedly some cases which can be saved by early incision and drainage.

The cases which go on to the subacute stage or are subacute from the start should receive earlier operation than has been the custom in the past. We should, in fact, hope to save many of these cases, as they do not die from the effects of the sudden collapse, but rather from the results of septic absorption or from exhaustion. The drainage of the area containing the necrotic pancreas or the abscess cavity will prevent spread of the necrosis and burrowing of the pus. The suppuration that occurs in the pancreas will of course be most easily checked when it is localized in one portion of the gland or has formed a peripancreatic collection. Multiple abscesses in the

pancreas will necessarily have a bad prognosis, and surgical treatment will be of slight avail. It is with peripancreatic suppuration that the surgeon has chiefly to deal, and it is of great importance that this should be attacked before it has burrowed too extensively.

The retroperitoneal connective tissue is very favorable for the extension of the suppurative process, and when burrowing has begun it may be later very difficult to control. The pus may easily spread to the space above the spleen, forming a subphrenic abscess. Furthermore, it has been known to perforate the diaphragm, resulting in empyema. If it spreads anteriorly, it may fill the lesser cavity, may rupture into the general peritoneal cavity, or may perforate the stomach or intestine. The patient in time becomes septic or succumbs to peritonitis. Spontaneous cure from emptying of the abscess into a viscus has been reported. Even though there is no collection of pus and burrowing, the presence of a necrosed pancreas is sufficient to cause death from septicæmia. There is constant absorption from the sloughing area, the fat and other tissues in the vicinity undergo the changes associated with fat necrosis, and there is progressive emaciation and exhaustion. In one of the cases observed at the New York Hospital the onset was subacute, but the patient had the last six days a septic temperature reaching 107° F. with chills. The diagnosis not being made, no operation was performed. The autopsy showed a sloughing pancreas with no pus. Early evacuation of this necrotic mass might have given a different result, especially as the onset of the attack was not accompanied by collapse.

In draining a necrotic pancreas or peripancreatic abscess an anterior exploratory incision is advisable, and if it is found that the pus lies in front, *i.e.*, in the lesser peritoneal cavity, the abscess may be drained through this incision, with possibly a counter-incision posteriorly. This posterior opening should be made if possible on the left side, as the vessels are much less numerous and formidable than on the right. By exploring the interior of the pus cavity, the best point for making the

posterior counter-opening can be determined and the large vessels avoided.

If it is found that the abscess extends entirely in a posterior direction, the drainage may be made wholly through an incision in the back, beginning at the costovertebral angle and extending downward and outward. This incision will usually be made on the left side, owing to the easier approach to the pancreas than on the right. By displacing the kidney outward, it is not difficult to bring the left end of the pancreas into the field of operation. This posterior incision has both the advantage of affording freer discharge in the recumbent position and of not opening the peritoneal cavity. In case the pus has burrowed under the diaphragm, resection of one or more of the lower ribs may be advisable, and then the suphrenic space properly drained. Empyema from rupture through the diaphragm will receive the usual treatment. All of these complications can be avoided by early operation.

The mortality of operations for suppuration and gangrenous pancreatitis is at the present time still high. Out of twenty cases collected by Boeckel, nine died. In four cases of Robson's, two died. The two which lived were incised in the loin, while the two which died were drained through the anterior incision. Earlier operation, if possible in the acute stage, should improve these figures.

If we turn now to the chronic inflammations of the pancreas, we find a much more hopeful field for surgical treatment. The conditions which bring about a chronic interstitial inflammation of the gland are both local and general. Among the local causes, the presence of stones in the gall-bladder or ducts is the most common. The frequent presence of chronic inflammation of the pancreas, particularly its head, in cases of cholelithiasis, has of late been the subject of comment by surgeons. The irritation or inflammation of the gall passages produced by the gall-stones is propagated through the pancreatic duct, and thus a mild acute, and finally a chronic, inflammation may be set up. Among general causes, alcoholism and syphilis are the most important. This chronic inflam-

mation results in a hypertrophy of the connective tissue of the gland, causing an enlargement chiefly of the head. This may not cause any disturbance in itself, and may be discovered by accident in gall-stone operations. Furthermore, it may disappear spontaneously. Thus Sendler reports a case in which pain in the epigastrium and the appearance of a swelling led to exposure of an enlarged nodular pancreas which was supposed to be a malignant tumor. The abdomen was closed without further interference. Three and a half years afterwards the patient was perfectly well, the tumor had become much smaller and not painful. In time this chronic inflammation may, like other diseases of the pancreas, lead to loss of flesh and strength, and finally to diabetes in case most of the glandular structure disappears. Certain cases of chronic interstitial pancreatitis involving the head of the organ may give rise to obstructive symptoms on the part of the gall-bladder and ducts. There is usually in these cases a thick growth of connective tissue, a sclerosis, and contraction of the head of the gland which compresses the common duct, and causes, finally, complete obstruction of the outflow of bile into the duodenum. There may be as complete obstruction as in cancer of the head of the pancreas, and this similarity is made still more evident in case there is progressive emaciation which frequently accompanies chronic pancreatitis as well as carcinoma. In both instances the gall-bladder is likely to be very much distended as contrasted with the contracted gall-bladder accompanying obstruction from a gall-stone. Most cases of this sclerotic condition of the head of the pancreas have been diagnosed as cancer previous to operation. Exploration with palpation of the gland does not always clear up the diagnosis, as in both conditions there may be the same nodular appearance and feel. The irregularity of outline and firmness of structure of even a normal pancreas when slightly larger than usual may give rise to errors of diagnosis. The presence of enlarged glands will of course indicate carcinoma as well as the existence of ascites. A number of instances have been recorded where the operator mistook the chronic inflammation

for carcinoma, and either closed the abdomen at once or performed a cholecystenterostomy for temporary relief of the biliary obstruction. In some of these instances the bad prognosis given at the time has not justified itself, and the patient has completely recovered, and remained well for years afterwards.

The rule should always be, therefore, to treat every case of chronic enlargement of the head of the pancreas with biliary obstruction as though it were chronic inflammation, unless there are unmistakable signs of carcinoma. In this way a permanent cure may be obtained in chronic inflammation, and no harm has been done in case the enlargement proves to be a carcinoma. Without operation the prognosis of chronic pancreatitis is dubious. It may continue without great disturbances for months or years, but there is always the possibility later of glycosuria, increasing loss of flesh and strength, cholæmia, and hæmorrhagic tendencies.

The usual operations for chronic interstitial pancreatitis involving the head of the organ with distention of the gall-bladder are cholecystotomy and cholecystenterostomy. The former by providing simple drainage of the gall-bladder will relieve the congestion in the bile ducts, and may thus diminish the inflammatory enlargement of the pancreas. This in turn will relieve the compression of the common duct, and the bile may then again enter the intestine normally.

When the swelling and thickening of the head of the pancreas are due to the presence of gall-stones and have not reached the stage of contraction and of obliteration of the opening of the common duct, the gall-stone operation will likewise be sufficient to bring about a complete disappearance of the inflammatory swelling of the pancreas. This fortunate outcome may not occur, however, in the cases of sclerosis of the head of the pancreas where the interstitial growth of fibrous tissue is abundant and has firmly compressed the opening of the common duct. In such a case the choice will lie between a permanent biliary fistula or a cholecystenterostomy. Each has its advantages and disadvantages. The latter meets the

indications, and does not entail the discomfort of a permanent fistula. Cholecystotomy is, however, a much less serious operation, is much simpler to perform, and involves less danger of fatal hæmorrhage, which is always possible on account of the extreme cholæmia. In fact, the mortality of cholecystenterostomy from this cause is very high. Hence operative measures should not be delayed until the cholæmia has reached a dangerous degree and the patient has become much weakened. In the earlier operations the prognosis is good. Out of seventeen cases of Robson's, sixteen recovered, and in all these there was complete restoration to health. In case the gall-bladder is enormously distended and extends over the anterior wall of the stomach, cholecystogastrostomy may be indicated, and in such a case would be easier to perform than cholecystenterostomy. Experience has shown that no ill effects upon the digestion result from the passage of bile directly into the stomach, and there need be no regurgitation of the same.

Tumors of the pancreas offer as yet a very unsatisfactory field for operative treatment. The diagnosis in the earliest stages is practically impossible. Even though one *were* able to detect a beginning carcinoma or sarcoma, removal would in most cases prove a most bloody and difficult procedure. Extirpation of the entire organ, even though it were technically possible without injury to other organs, is inadmissible, since the researches of Mering and Minkowski, who by experiments upon animals demonstrated that the pancreas is necessary to life. Tumors localized in the tail of the pancreas would be the most favorable ones for removal, but the diagnosis would be difficult during the early stage. Carcinoma of the head of the pancreas causes early symptoms of biliary obstruction, but excision of such a growth would doubtless mean gangrene of the duodenum or some part of the intestinal tract, from ligation of its nutrient vessels.

As regards palliative measures, the outlook here is equally dismal. Cholecystenterostomy is a most dangerous operation in case cholæmia is well marked or the patient is cachectic. Furthermore, the statistics show that the duration of life after

this operation has never exceeded fourteen and one-half months. Boeckel holds that the risks of the operation are not compensated for by the advantages gained. In fifteen cases there were seven sudden deaths after the operation. Cholecystotomy meets the indications about as well. Its immediate mortality is much lower, and, as life is not greatly prolonged by either operation, the existence of a biliary fistula is of no great moment. Furthermore, an external fistula insures a certain and permanent escape of bile from the gall-bladder, which is not always the case after cholecystenterostomy. The relief to the patient from escape of the pent-up bile is very great, but distention of the abdomen and other symptoms due to the presence of the tumor and metastases soon supervene.

A warning should once more be given against making the diagnosis of carcinoma of the head of the pancreas on too few data. The mere presence of chronic obstruction of the common duct without a history of gall-stones is not sufficient. Neither is the existence of a nodular enlargement of the head of the pancreas with or without biliary obstruction. Neither is accompanying emaciation. All of these may be found in connection with chronic inflammatory changes in the head of the organ. A fairly positive diagnosis can be made from the existence of glandular enlargements, ascites, and marked cachexia. If there is a reasonable doubt, the patient should be given the benefit of this and an exploration performed.

If after laparotomy no sure evidence of carcinoma is obtainable, we should then consider the enlargement inflammatory, and meet the most pressing indications, viz., biliary obstruction, by cholecystotomy or cholecystenterostomy. A permanent cure may then follow in case the enlargement proves to be inflammatory.

The literature of pancreatic surgery is very small. Few surgeons have opportunities of seeing more than isolated cases of pancreatic disease, and consequently do not obtain sufficient experience to contribute much to its operative treatment. In order to establish permanent methods of treatment, it is desirable, however, that these isolated cases should be reported,

whether operated upon or not. By thus combining the small experience of many, the pathology and symptomatology of the obscure conditions will become more firmly established, the correct diagnosis will be made more frequently and earlier, and the surgical treatment will become more intelligent and fruitful of better results.

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OSTEOPLASTIC RESECTION OF THE SKULL BY MEANS OF A NEW TREPHINE.[1]

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Various methods are practised for effecting an opening into the cranial cavity. The one most frequently used is the old operation of trephining. This plan will probably always be the method of choice in the majority of cases. It exposes, however, but a small area for inspection and for operation, and, if it is necessary to expose a large area, the bone around the trephine opening must be cut away with rongeur forceps. When such an operation is finished, a large gap is left in the skull; and, because of the fear of hernia cerebri and of apprehension as to future injury from without, various ingenious methods have been practised to effect a closure of the opening.

The osteoplastic method of resection of the skull, originally suggested by Wolff and put into practical execution by Wagner in 1889, makes an opening into the skull by cutting what is practically a trap-door in the bone. This trap is held open, the operation is completed, and the trap is replaced. In certain cases such a method is distinctly advantageous. It enables us to expose as large a surface as may be necessary, because a large bone-flap of this description will unite, when returned to place, as easily as a small one. The osteoplastic method is the one chosen in most exploratory operations, where we fancy that there may be a tumor; in some operations for the removal of known tumors, and in operations for epilepsy.

[1] Read before the Philadelphia Academy of Surgery, March 3, 1902.

The bone-flap is usually cut by the use of chisels or gouges of special construction. It takes a long time to complete the chiselling, and the employment of the mallet or hammer may, by repeated tapping or more violent jarring, injure the nervous structures within the skull. In such a condition as abscess of the brain, hammering may lead to diffusion of the abscess; if hæmorrhage exists, it may increase it or it may cause hæmorrhage; and in using a chisel there is always some danger that a fracture will extend out far beyond the point which we desire cut. Many surgeons feel apprehensive in using the chisel and mallet for opening the skull. It is my personal belief that the hammer increases the shock and distinctly adds to the risk of the operation.

In order to avoid this risk, some surgeons cut an osteoplastic flap by means of the Gigli saw. To use this saw, it is necessary, first, to make several or a number of trephine openings. To do this requires the expenditure of a great deal of time. The saw, when put in use, cuts from within outward, which is the safe way, but the operation requires much time to perform.

Other surgeons cut the bone-flap by means of a surgical engine, and this would seem to be the ideal method; but the handle of the cutting-saw in the engine is difficult to satisfactorily sterilize, and the engine runs the saw with a speed so great that long training and the utmost care are required to cut with safety. I have no doubt that a surgeon can train himself to work accurately with a surgical engine, but I do not believe that the implement is destined soon to come into really general use.

Recently, Dr. T. C. Stellwagen, Jr., a dentist and a student in the third-year class of the Jefferson Medical College, devised an instrument designed to cut an osteoplastic flap with a minimum expenditure of time and without inflicting any serious concussion upon the intracranial structures. After constructing this instrument, he experimented with it upon the dead body; and I joined him in some of these experiments. We determined that certain alterations were necessary in the instru-

ment as originally constructed, and, after these had been made, we used it with much satisfaction upon a patient in the hospital of the Jefferson Medical College.

This patient was a child who was laboring under epilepsy and hemiplegia, the condition having followed an attack of diphtheria. A large-sized osteoplastic flap was cut in an extremely short space of time with ease and certainty, the chisel being lightly used to complete the division of the inner table of the skull. In using the saw, it was found to be undesirable to take it at each turn through the whole length of the half-circle. It was moved rapidly to and fro over a short portion of the length of the circle; then over another portion; next over another; and so on, until the whole had been traversed. The outer table and diploe were very readily cut through, and the inner table was satisfactorily divided. The skull was of moderate thickness. It is evident that in a very thick skull this operation would be more difficult, and would require especial pyramidal, sharp-cutting instruments, in order to make a sufficiently large opening in the bone to enable the surgeon to locate the position of the point. In fact, in none of these cases would a very narrow cutting instrument do; because such a line of incision in a bone would not admit a chisel to complete the division and to pry up the bone-flap. The flap in this case was raised with the utmost ease; and after the completion of the operation, when the bone was replaced in position, it fitted with an evenness that is not seen after the ordinary operation with a chisel.

This instrument consists of a handle and a shaft, as does an ordinary trephine. Screwing into the end of the shaft is a movable centre-pivot or point instead of the pin seen in the ordinary trephine. Dr. Stellwagen and I discovered, while working on the dead body, that a sharp and long centre-point might bore through a thin skull,—a danger which had to be obviated by modifying the instrument. The danger of such a puncture is reduced to a minimum by placing a shoulder above the point, which shoulder prevents the possibility of any deep penetration. Another method is the use of a centre-plate, with a hole for the pivot, and with sharp points on the under side, these points being driven through the scalp and a short distance into the skull, thus assuring fixation. It was this latter method which I employed in the case of the child above mentioned.

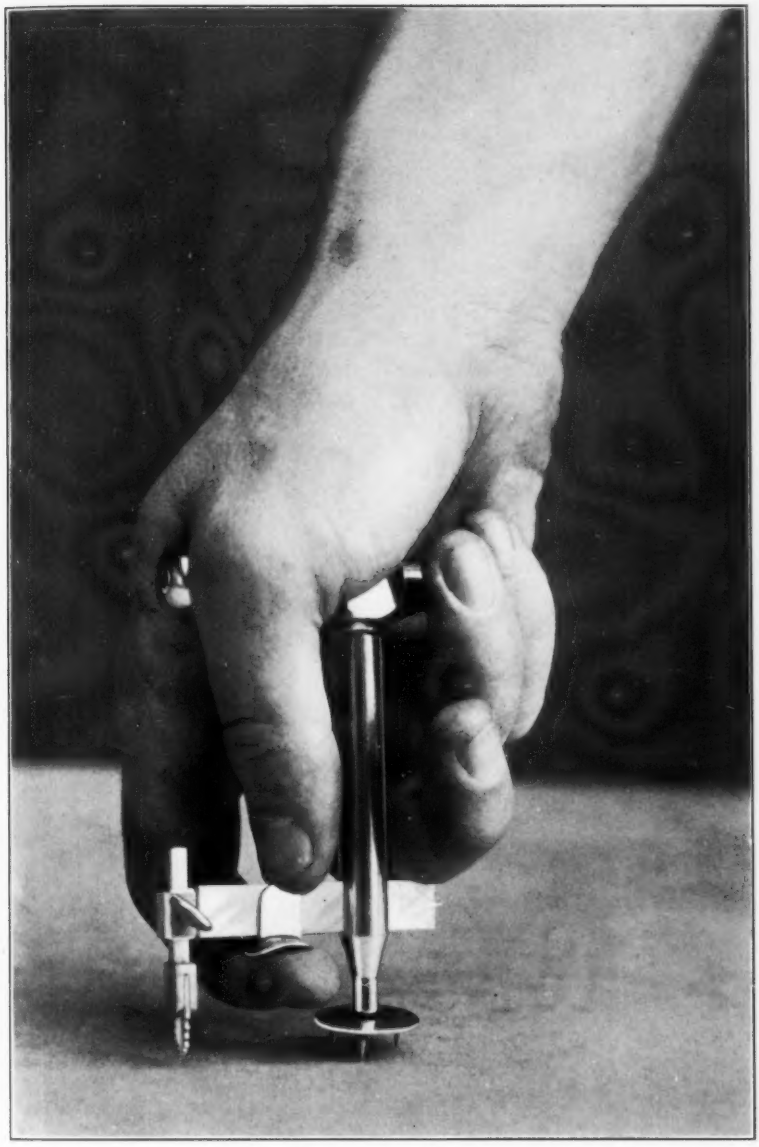

FIG. 1.—The method of using Stellwagen's trephine.

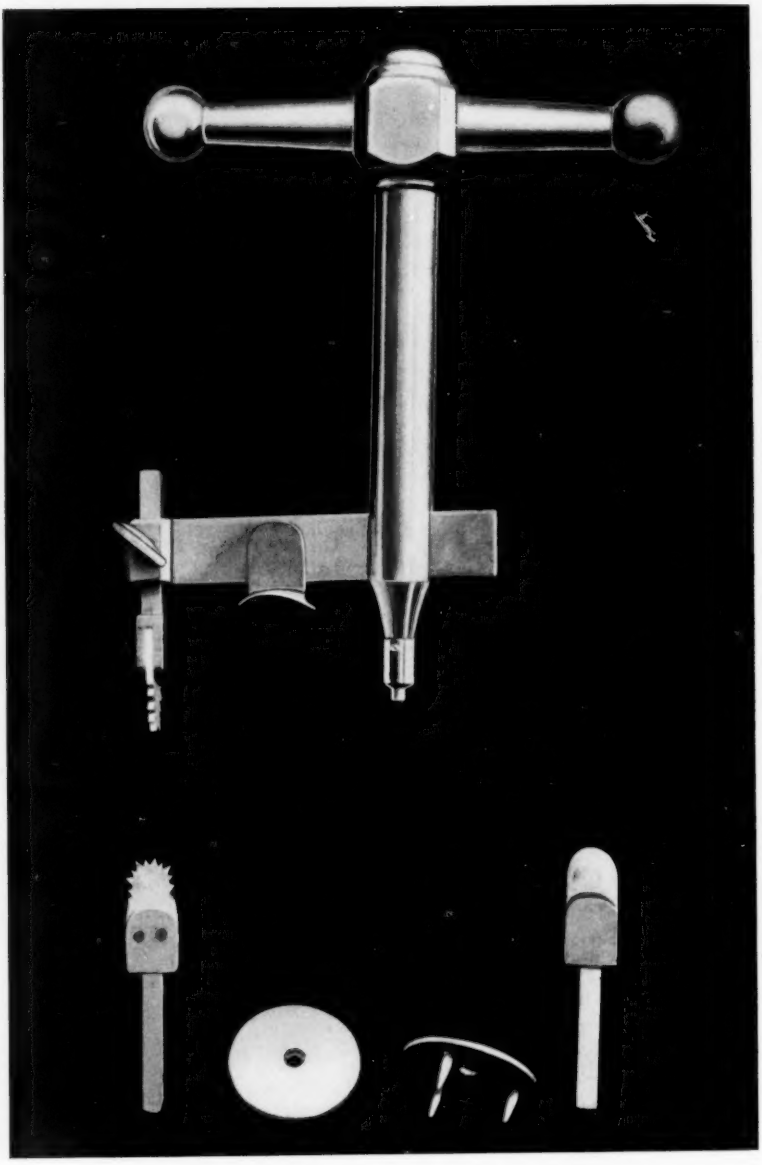

FIG. 2.—Shows the saw, the plates, and the knife, and also the instrument put together and ready for cutting the bone.

Plates containing points of several sizes should be used, the thickness of the scalp determining to some extent the length of point which it is necessary to employ. If care is taken that sufficient length is used to go but a short distance through the scalp, there is no real danger of penetrating the skull with the point.

The centre-pivot, too, may be changed, a short or a long one being used as desired. Dr. Stellwagen says that when using the centre-pivot without the plate it has been found practicable upon the cadaver to start it with an appropriate drill, sinking the hole just deep enough to prevent slipping of the instrument. Thus, a centre-pivot with a blunt end may be used for the final work. Dr. Stellwagen's description of his instrument is as follows:

The instrument, with its parts assembled ready for use, consists of a shaft pierced by an oblong quadrilateral hole, through which is passed a piece of steel at a right angle, the projection of this piece of steel being regulated by a set thumb-screw. This device enables the surgeon to cut any desired size of bone-flap. The projection-bar has a gear-hole forged in its outer or cutting end, into which fits the shaft of a movable knife and movable saws, which are used for incising the scalp and for dividing the bone. The saw may be raised or lowered to suit each case and to permit of adjustment to the inequalities of the skull, and, when once set, may be clamped by a thumb-screw. Several different forms of bone-cutting instrument were tried at various times upon the cadaver, but were discarded as being conspicuously inferior to the saw.

Fig. 1 shows the proper way to hold the osteoplastic trephine. It will be observed that the index-finger is hooked beneath the finger-guard on the bar, and not extended along the shaft of the instrument, which is the method employed in using the ordinary trephine. The manner of holding this instrument should be most particularly observed, as the success of the manipulation largely depends upon absolutely controlling, at the same time, the saw and the centre-pin. By holding it correctly, the greatest amount of power is obtained with the least resistance and the slightest pressure; thus, the control and power of the instrument are much increased.

Fig. 2 shows a knife for making the incision through the scalp and periosteum, which device was suggested by Professor W. J. Hearn. The employment of this knife shortens the time

required to incise the flap and expose the bone, and it makes the scalp incision accurate; this is necessary when we are going to use a bone-cutter which moves with absolute accuracy. Furthermore, the consequent cicatrix is neater than when the incision has been made with a knife. It is difficult or impossible to make an absolutely circular cut with a knife. Even if we attempted to cut a half-circle, there would be irregularity and nicking of the edges.

Fig. 2 also represents the saw, the diagram being of the actual size. A saw of this character and size has been found to be the most successful. This saw is easily kept in order, and can be readily sharpened. It must be thick enough to cut a fairly wide groove; must have long teeth, properly set, polished, and sharpened. A saw of the character shown in the cut will make the bone section without jamming or clogging with bone dust. The surgeon should have several saws of different lengths until he becomes accustomed to the use of the instrument. When the kerf is deep and the skull thick, a longer saw may be inserted. This would prevent sudden plunging of the blade into the dura. The shoulder, which is shown in the cut, will prevent such slipping.

Fig. 2 also shows the plate, the pins of which pass through the scalp around the centre of the circle selected for operation. When they engage the bone, a few light blows of the mallet will cause their entry into the skull.

In performing the operation on the case before referred to, it was found that not only did the plate serve as a satisfactory centre for turning the instrument upon, but it also kept the scalp fixed to the bone and prevented the stripping or separation which is apt to occur, to a greater or less degree, in an ordinary osteoplastic operation. The centre-point, or pivot, of the osteoplastic trephine is introduced into the hole in the plate. This prevents slipping of the instrument. The scalp is then cut through with the knife and the bone cut through with the saw, with the least possible expenditure of labor.

Dr. Stellwagen further observes that in proportion as one's hand becomes trained in the employment of the instrument, so will the necessity for the use of the mallet and chisel decrease; as, with care, not only may the outer table and the

diploe, but also a considerable thickness of the inner table, be cut through with the saw, so that with a very few light blows of the mallet upon a chisel the section may be completed. The bone should be divided well up to where the fracture is to be made through the base of the bone-flap. By so doing, a clean break can be obtained with the least possible amount of prying. In fact, it would be advisable to cut the scalp and the bone-flap rather in the shape of a clover-leaf than in that of a semicircle. It would be well for the surgeon to practise with this instrument upon the dead body before using it upon the living.

The inventor shows that this instrument can be employed for cutting a complete circle; that when it is used for this purpose, it is adaptable to the inequalities of the bone; and that a circle of practically any size can be cut with it. This one instrument, therefore, can cut a trephine opening of any size. I believe, however, that the ordinary trephine is still the instrument to be preferred in making a moderate-sized trephine opening; but if we wish to remove a very large circular piece of bone, I think that Stellwagen's instrument should be given the preference. Its inventor likewise suggests that this instrument might be used for the removal of portions of other bones.

I agree with the conclusions of the ingenious deviser of this trephine, which are that its simplicity of construction, the ease with which it can be manipulated and sterilized, its freedom from the danger of disarrangement or crippling, the speed with which it can be set, or sharpened, if need be, its adaptability to various cases, its cheapness, and the fact that either an osteoplastic flap or a circular piece can be rapidly cut by it, make it an instrument which will probably be regarded as most useful to the surgeon.

MOTOR APHASIA DUE TO A SMALL CORTICAL HÆMORRHAGE IN THE REGION OF BROCA'S CONVOLUTION; TREPHINING; RECOVERY.[1]

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This patient furnishes, I believe, a typical example of complete motor aphasia from the pressure of a small blood-clot in the region of the motor speech centre of Broca, at the anterior portion of the left third frontal convolution of the brain. It illustrates, also, in a very striking manner, the results of indirect violence in the production of a cerebral injury.

As the case presents some rather unique and instructive features, it is deemed worthy of record.

D. McG., aged thirty-nine years, single, was admitted to the wards of the J. Hood Wright Hospital on February 8, 1902. On the evening before admission the patient, while standing upon a very narrow step of a flight of cellar-stairs, talking, had lost his balance and fallen backward for a distance of about nine feet, striking presumably upon the back of his head. His physician, Dr. Merrigan, stated that he was picked up unconscious, and had so remained for about eight hours. When he recovered consciousness he appeared dazed, and had great difficulty in talking. It was also stated that he had bled rather freely from the right ear. As his condition did not improve, but became worse, he was sent to the hospital, to which he was able to walk. On admission, the examination showed the patient to be a well-nourished and strongly built man. The examination of the heart, lungs, and abdomen was negative. It was noted that the patient

[1] Presented before the New York Surgical Society, February 26, 1902.

looked dazed. No paralysis was noticed at this time, grip in both hands strong. He appeared to feel weak and to be much distressed over his inability to talk. He recognized objects presented to him, and if asked if he knew what the object was, responded with "Yes," "Certainly," but could not name it. He could not speak his own name, but could write his first name, or rather the first part of it, fairly well. He could say "Yes," "Certainly," "Sure," and some other words not noted, and used these frequently and instead of the words he wanted to use. It was also noticed at this first examination, that when a question was put to him he would make great efforts to answer it, as shown by the expression of his face, and after a struggle give it up without articulating a single word.

At the time of admission his temperature was 101° F.; pulse, 90; respirations, 20. Urine, amber, clear, alkaline, 1035. Albumen, faint trace; sugar, none. Microscopic examination negative. Few red cells, urates, mucus. There was a small contusion and abrasion over occiput right side. Patient put to bed and ordered sodium bromide, twenty-five grains, every three hours.

February 9.—Slept at intervals during night, but quite restless this morning. Temperature rose to 102° F. at noon. Condition worse. It was noted that fluids ran out of the side of his mouth while drinking. This is the first time the facial paralysis was observed. Fluid diet, cathartic ordered.

February 10.—Slept fairly well the greater part of night. In the early morning there was some bleeding from the right ear. Temperature at 8 A.M., 101.6° F.; pulse, 68. Aphasia practically complete; attempts to answer but a few questions put to him. During the afternoon he was first seen by the writer. At this time an examination showed the patient to be completely aphasic. When asked to write his name, he held the pencil rather clumsily, but succeeded in writing his first name with considerable difficulty and very slowly. The first letters are fairly legible, but the last three or four are a scrawl, sagging far away below the beginning of name. The grip of the right hand is not noticeably weakened, and there is no paralysis of the lower extremity. The right side of the face is somewhat flattened, the angle of the mouth lower than on left side, and the protruded tongue deviates to the paralyzed side.

During the further examination of the patient, an effort was

made to see whether he could speak any word. He was able to apprehend clearly the questions and to recognize the objects shown him, but absolutely unable to utter one single word. His efforts to speak were so strenuous that clonic convulsions of the right side of the face and neck, accompanied with expiratory grunts, occurred, apparently without loss of consciousness and lasting but a few seconds only. This convulsion was twice observed during the examination, and was reported as occurring once more during the preparations for the anæsthetic. The presence of the motor aphasia with the right facial palsy pointed clearly to pressure over the speech area of the cortex, and immediate operation was advised and done.

Operation.—Ether anæsthesia. A horseshoe-shaped flap of skin, muscle, and periosteum was made, and turned downward in the usual manner, exposing the side of the skull over the motor area of the cortex of the left side of the brain. A half-inch conical trephine was then entered, at a point about one and a half inches behind the external angular process, and the same distance above the level of the zygoma, and a button of bone removed.

The dura mater beneath the opening appeared black, tense, and pulseless. There was no hæmorrhage outside the dura, nor any evidence of fracture of the skull in that region. The trephine hole was enlarged in a forward and downward direction, and the field occupied by the clot clearly exposed. The dura was opened by a curved incision and turned down, exposing the clot beneath. Some dark fluid blood had already been withdrawn by an aspirator-needle before opening the dura, and a little more escaped as soon as it was incised. The hæmorrhage, so far as could be observed, did not come from the vessels of the dura, but from some small cerebral branches. The clot was firm and moderately adherent to the cortex of the brain, and had to be washed away with a stream of salt solution, and some of it was detached carefully with a smooth blunt instrument. Two or three small fragments of brain substance came away with the washings, and there was, perhaps, a slight cortical laceration near the anterior edge of the trephine opening, but its extent was not clearly made out. Some slight oozing of red blood occurred after removal of the clot, but soon ceased.

The flap of dura was carefully replaced but not sutured, and

the rest of the wound was closed in the usual manner, provision for temporary drainage in the event of possible oozing being made by the introduction of small strips of wet rubber tissue into the lower angles of the wound. The patient was returned to the ward and made a good recovery from the ether. About 8 P.M. he had a slight convulsion of the right side of face, similar to the one described; and an hour later had another slight convulsion, which seemed to involve the arm and leg also, but was very slight and only lasted a short time. He was given morphine and slept most of the night.

February 11.—Seems quiet and dazed to-day; rouses when spoken to, but mumbles only in response to questions. Slept the greater part of the day. Towards evening began to say some words when spoken to, as "Yes," "Sure," "Certainly!" Apparently, from signs and expression on questioning, he seems to be suffering considerable pain in his head. Highest temperature 100.8° F. No more convulsions.

February 12.—After a comfortable night, seems much brighter. Wound dressed, drains removed. Very little bloody discharge from wound; no infection. The patient can answer simple questions intelligently; he no longer misuses words, although he speaks slowly and with considerable hesitation. Can pronounce the vowels, but stops at some of the consonants, merely saying, "Yes," or not attempting them at all.

February 13.—Rapidly improving. When asked how he felt to-day, responded, "Fine! I think I am improving regular." He has still considerable pain in the head, and complains especially of a sensation of dizziness at times.

February 15.—Out of bed. Speech improving steadily, though there is still at times considerable hesitation. Gives his name and address correctly.

February 19.—Still hesitates over some consonants, especially the ones near the latter end of the alphabet, while repeating same; seeming to forget, or at least not seemingly able, to pronounce the last part so well, especially the consonants, and occasionally repeating some letter in the first part. Converses about his injury, however, very intelligently.

February 21.—Dressings removed. Wound entirely closed. Cotton and collodion dressing. Patient up and about ward; says the dizziness troubles him less. Pronounces the whole alphabet

fairly well, and, with the exception of a slight hesitation in speech at times, talks naturally.

The later history of the case shows a gradual disappearance of the headache and dizziness and a restoration of confidence on the part of the patient in his ability to talk. Since his discharge from the hospital, the writer has seen the case several times, and in the latter part of March he reported himself as feeling as well as he ever did, and his speech apparently normal.

OPERATIONS UPON THE KIDNEY AT THE GERMAN HOSPITAL IN PHILADELPHIA.[1]

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From the beginning of 1899 to the present date there were performed in the German Hospital, in Philadelphia, thirty-four operations for the fixation of floating or movable kidney; seven for nephrolithiasis; three for pyonephrosis; two for hydronephrosis, and two for sarcoma and nephrotomy or pyelotomy.

Nephropexy.

Of the floating kidney operations there were twenty-nine on the right kidney, four on the left kidney, and one bilateral. Six of the cases also suffered from chronic appendicitis, and this organ was removed at the same time. One case had had an appendectomy performed one year previously. Two cases had cœliotomy performed some years previously for tubal troubles. One case was two months pregnant and recovered without mishap. Thirty-one cases were females. Three cases were males,—one on the left and two on the right kidney. Thirty-two cases recovered. Two cases died (6.7 per cent.), one thirteen days after operation from acute mania, and the other in four days from uræmia. Both of these cases were males.

A blood count was made on seven cases before operation and averaged, hæmoglobin, 60 per cent.; red cells, 3,610,000; white cells, 7960. In no case was a leucocytosis observed.

The patients were in the hospital on an average forty-four days,—excluding the two deaths and three cases still in

[1] Read before the Philadelphia Academy of Surgery, March 3, 1902.

the hospital. Shortest confinement in hospital, twenty-two days; longest, seventy-five days.

Ether was used in all cases and without any difficulty, patients leaving the table without medication. Of the thirty-four cases, thirty-two were operated with the diagnosis of floating or movable kidney. Two cases had the diagnosis made of stone in the kidney. One case negative to X-ray examination, and the other positive; both here and at another hospital. In neither case was a stone found, and the kidney was subsequently anchored.

The patient in all cases was laid on the side opposite the kidney affected, with the knees and thighs flexed and an inflated pillow beneath the loin. The incision was usually about three and a half inches long, extending along the outer margin of the erector spinæ from the twelfth rib towards the crest of the ileum, separating the fibres of the latissimus dorsi and laying bare the lumbar fascia. The fascia was then incised, exposing the perinephric fat and quadratus lumborum muscle, care being taken to avoid the lateral cutaneous branch of the last dorsal nerve. The posterior part of the fatty capsule was resected in all cases and the kidney delivered.

In three cases the true capsule was split from pole to pole, the kidney replaced, and the edges of the capsule united to the muscular layer by three chromicized catgut sutures on either side. Iodoform gauze was packed into the wound cavity and dressings applied.

In twenty-eight cases after delivering the kidney, its true capsule was well scarified with the blade of a scalpel, a strip of white or iodoform gauze was passed around each pole and the kidney replaced. Several pieces of gauze were packed in the wound cavity and the gauze around the poles tied over these. Dry dressing was then applied.

Three cases were operated by Edebohls's method. The kidney was exposed and delivered in the usual manner. The entire fatty capsule was then cut away. The true capsule was divided along the dorsum to the middle of each pole, reflected, and the excess cut away. Four mattress sutures were passed

through the reflected capsule, two on either side, near the poles, and left loose. The kidney was then returned. The eight ends of the four sutures were passed through all the abdominal parietes, except the skin. For the present these sutures are left untied. The muscles and fascia of the wound were then united by interrupted sutures. Then the two ends of each of the four suspension sutures were tied and the skin united over all.

In no case was the peritoneum opened. In no case was the patient very much shocked. In all cases there was a temperature varying from 99° to 100° F. after operation, and lasting from three to twelve days.

In only one case was vomiting present as a sequelæ beyond the usual results of ether narcosis. This case was the one on which a double nephropexy was performed. Vomiting was controlled on the third day by means of exclusive rectal feeding. One case developed a urinary fistula, which healed spontaneously on the fourteenth day. In one case the pelvis of the kidney and ureter was slightly torn during the operation; suturing with Lembert silk sutures resulted in primary union.

In all cases the gauze packing remained untouched for from six to nine days; it was then removed and the wounds mostly healed by granulation. In a few cases the patients were etherized, the edges of the wound pared, and the tissues brought together with silk or worm-gut sutures.

Most of the cases were discharged with a small granulating wound flush with the skin surface and with the kidney seemingly in good condition and position. None of the cases were readmitted.

It will be noticed that none of the cases were anchored by any method requiring sutures to be passed through the parenchyma of the kidney. I have long ago abandoned this method on account both of the danger of a subsequent pyonephrosis and its inadequacy.

In addition to a case in my own experience, two cases were reported by Dr. Heath, of England, in a personal communication to Dr. Keen, of pyonephrosis following kidney suture.

The operation of splitting the true capsule and suturing its edges to the muscular layers of the wound was found to be unsatisfactory for two reasons: first, urine was exuded from the surface of the kidney into the wound and greatly interfered with granulation. In one case contraction of the capsule forced the kidney out of the wound, and it was almost impossible to replace it. In fact, the case recovered, but the kidney is between and not below the muscular layers of the back. In spite of this malposition the patient is perfectly well, and has been since delivered of a child without any difficulty either during labor or afterwards.

The patients operated upon by Edebohls's method were a little more comfortable after operation than those anchored by gauze.

Of the two deaths in this series, the one due to acute mania had probably an alcoholic foundation; the one due to uræmia I am unable to satisfactorily explain, but it is tentatively suggested that perhaps it was due to a compression of the renal vessels and failure of the other kidney to establish compensation.

Nephrolithiasis.

Seven cases diagnosed clinically as stone in the kidney are reported in this group. On two of the cases, operation revealed the absence of a stone. One of these gave a positive shadow to an X-ray examination on two occasions, nine days apart. The other was not X-rayed. Both cases were on the left side. The first case was opened from pole to pole and no stone found whatsoever. Kidney closed and gauze placed around poles, as in nephropexy. Patient very much shocked and was transfused before leaving the table. In four hours marked hæmorrhage took place, the patient was given a little ether, and a complete nephrectomy rapidly performed. Death took place an hour later from shock.

The second case was operated on the same lines exactly, but the patient made a perfect recovery without a complication.

In five cases the diagnosis was confirmed by operation. Three cases were positive to X-ray. Two cases were not

examined by X-ray. Three cases were on the left side. One case was on the right side. One case was bilateral. Four cases were men. One case was a woman. All five cases recovered.

In two cases the stone occupied the pelvis of the left kidney. After the usual incision, the pelvis was cut open, the stones removed, and the wound closed with Lembert sutures. Both cases were anchored with gauze as in nephropexy, and both made a complete and uncomplicated recovery. Discharged on the twenty-first and forty-first days respectively, with small granulating wound.

In two cases, after the usual incision, the kidney was found not only to be filled with stones, but also the subject of pyonephrosis.

First Case.—Peritoneum opened in delivering the kidney, which was markedly adherent, closed immediately with catgut. Ureter ligated as low as possible, the vein and artery tied separately, and the kidney removed. The wound cavity packed with gauze and allowed to heal by granulation. Patient made a nice recovery, and was discharged in thirty-one days, with a small granulating wound.

Second Case.—Precisely as above, but peritoneum was not opened. Discharged in thirty-nine days with a small granulating wound.

One case bilateral.

June 4, 1900.—Incision as in nephropexy (left side), kidney opened from pole to pole, and a number of stones found in the pelvis and calices. All cleaned out and kidney brought together, packed, and anchored as in gauze nephropexy. The patient suffered very little from shock, but shortly became very septic, and several hæmorrhages took place from the kidney. Seventeen days after operation a stone was passed out of the wound. Eighteen days after operation the patient was re-etherized and the kidney (left) rapidly removed, and the cavity packed with gauze. The wound healed by granulation and, with the exception of considerable vesical trouble, the patient did very well. Improving gradually in weight and strength, and on discharge was able to walk about.

Exactly nine months later the patient was admitted with all

the symptoms of stone in the right kidney. Operation under chloroform revealed a hyponephrosis due to a stone in the pelvis blocking the ureter. Two large incisions were made through the cortex and six calculi removed from the pelvis. Incision was packed with gauze. During the next six weeks the patient was dressed every other day, and nineteen stones were discharged through the wound during this time. There were no uræmic symptoms, and the urine was passed both through the urethra and through a sinus leading to the kidney. Discharged nine weeks after operation with a urinary fistula, but in good general health.

Nephrectomy for Pyonephrosis.

Case I.—Female; right side. Incision from crest of ileum to anterior border of quadratus, nine inches long. Kidney delivered and aspirated, vessels ligated separately. Ureter ligated and stitched in wound. Kidney removed. Peritoneum not opened. Wound closed with silk sutures, with a rubber tube for drainage.

Patient became very weak and anæmic after operation, but recovered after a protracted convalescence. Discharged four months after operation.

Case II.—Female; right side. Operation the same as in preceding case, except that the peritoneum was accidentally opened, and immediately closed. Patient still in hospital, with a clean granulating wound and in good condition, twenty-eight days after operation.

Case III.—An X-ray made on this case showed a distinct shadow over the right kidney. *Operation.*—Long lumbar incision, and a second at right angles to the first going up over the two lower ribs, the ends of these were cut off with forceps. The kidney was enlarged and firmly adherent to the peritoneum. It was cystic and filled with pus. In delivering the kidney, the peritoneum was opened and immediately closed with catgut. The kidney was then removed, after ligating the artery, vein, and ureter, separately; wound packed with gauze and partially closed. Cultures made from purulent foci in kidney remained sterile. Patient was discharged five weeks after operation, completely recovered.

Nephrectomy for Hydronephrosis.

Case I.—Female; right side. Incision extending from right lumbar muscle over and beyond the anterior superior spine of the

ileum, with ileum about one and one-half inches above it. Tumor mass found as large as an adult head. In attempting delivery, mass was ruptured, and about 1000 cubic centimetres of cloudy amber fluid without urinary odor escaped. Sac wall and remains of the kidney were delivered, vessels and ureter ligated, and mass excised. Extremities of the wound closed, gauze drainage in the centre. Patient died on the second day of uræmia.

CASE II.—Male; right side. Incision as in first case. Kidney delivered and aspirated, vessels ligated separately. Ureter ligated and stitched in abdominal wound. Kidney removed, peritoneum not opened. Wound sewed up with silk sutures, using a rubber tube for drainage. Wound healed by first intention. Patient never had a bad symptom. Discharged three weeks after operation.

NEPHRECTOMY FOR SARCOMA.

CASE I.—Female; right side. Incision through right rectus, nine inches long, growth seen to be retroperitoneal and attached to kidney. Parietal peritoneum clamped to mesocolon; growth enucleated, considerable bleeding in doing so. Tumor about the size of a child's head and was lobulated. Parietal peritoneum was then stitched to mesocolon (ascending) and gauze packed into the cavity. Patient was severely shocked and died three days after operation.

CASE II.—Male; left side. *Operation.*—Patient placed on right side, resting on an air-cushion. Incision made extending from the angle between the erector spinæ and the last rib, obliquely to the anterior superior spine of the ileum. All flat muscles were divided down to the lumbar fascia; this was divided, exposing the perirenal fat. Perirenal fat picked up with forceps and divided, and pressure anteriorly brought the kidney mass into the wound. Dissection round the kidney mass of the perirenal fat was carried on with index-finger. Many adhesions were found, especially at the upper pole. Terrific hæmorrhage occurred at all points, which was very difficult to control on account of size of vessels. Thought best to try to tie the renal vessels as soon as possible. Upper angle of the wound was packed with gauze as tight as possible, to check hæmorrhage, and dissection of kidney mass attempted from the lower end. The ureter was first exposed in a dense mass of adhesions. It was ligated and

cut. Further dissection exposed the renal vessels, which were clamped and cut. A dense mass of adhesions was encountered at the upper end. It was adherent at all points. The broken-down tissue resembled wet, coarse sawdust. The kidney was now removed and as much of the tissue as possible was scraped away from all adjacent structures; all bleeding points ligated. The kidney mass was about the size of a very large cocoanut, of firm consistency at the lower pole, but friable and spongy at the upper. The wound was then packed with large pieces of iodoform gauze, and partially closed with silk sutures. Before this could be done the patient went into collapse, almost pulseless, with shallow breathing. Hypodermics of atropine and strychnine were given and intravenous injection of hot saline was administered. Patient reacted slightly before leaving the operating-room. Dry dressing applied. At no time was the peritoneum opened.

Congenital Absence of Left Kidney; Obstruction of Right Ureter by Stone.

Male; sixty-five years old. Suffered from severe abdominal cramps one week before admission, which yielded to mustard-plaster treatment. Two days before admission was suddenly taken sick with severe pain in right flank, testicles, and penis, suppression of urine, which continued until operation. Examination showed marked tenderness in the region of the right kidney, bladder empty.

Incision was made in the right flank parallel to the crest of the ileum extending round in front nearly to Poupart's ligament; the kidney delivered and ureter found much distended with urine. The kidney was about twice the normal size and very dark. On account of the fatness of the patient and his bad condition, a very thorough exploration of the ureter could not be made. The pelvis of the kidney was opened and a rubber drainage tube put in, coming out through the back; gauze was packed in and the incision partly closed with silkworm-gut sutures. Patient died in three days from uræmia. At post-mortem the left kidney was found wanting, the left ureter being represented only by a fibrous cord extending down through the inguinal ring to the scrotum. A small stone was found blocking the right ureter near the bladder.

HYDATID CYSTS OF THE KIDNEY.[1]

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THE case I report furnished no previous history suggesting hydatids of the kidney. This condition was accidentally found during an operation for appendectomy. In the light of the operative findings and from a study of the specimen, I think the case furnishes some interesting features bearing on this rare disease.

G. D., Italian, aged thirty-two years, entered Harlem Hospital, December 26, 1901. He could speak no English. Examination showed a double inguinal hernia of the oblique, reducible variety. The right hernia reached the scrotum, the left only through the external inguinal ring. Temperature, 99.8° F.; pulse, 48; respiration, 22. He desired operation for the ruptures.

The following day, December 27, his temperature, which was normal in the morning, rose at 5 P.M. to 102.4° F.; pulse, 80; respiration, 28. No record of a chill. By gestures he indicated that there was pain in the abdomen.

Urinary Examination.—Color, pale straw. Reaction, acid. Sediment, moderate. Specific gravity, 1020. Albumen, absent.

On examination, tenderness was most marked over the right iliac fossa with some rigidity of the overlying abdominal muscles. An ice-bag was applied to the region and calomel in divided doses given. At 9 P.M., same day, temperature, 99.4° F.; pulse, 84; respiration, 26. On the 28th, the morning temperature was 102° F.; pulse, 84; respiration, 28. Epsom salts had been given early in the morning, followed by several movements

[1] Read before the New York Surgical Society, April 23, 1902.

of the bowels. An examination of his lungs showed dulness, prolonged high-pitched respiration, a few râles, and absence of tactile fremitus at the base of the right lung behind.

His abdominal symptoms were a little more severe, muscular rigidity spreading to include the right rectus and a greater tenderness over the appendix.

Diagnosis.—Pneumonia of the lower lobe of the right lung and acute appendicitis.

During the 29th the temperature remained the same, the pulse rose to 90 and 94, and respiration 28 to 30. On the 30th the temperature was 103° F.; pulse, 102; respiration, 22. The signs of an acute appendicitis were all present. A point of maximum tenderness in the right iliac fossa, general tenderness all over the abdomen, muscular rigidity increased so that the right abdominal muscles were all firmly contracted, and the patient used about the only two words he knew to tell us he had "much pain" in the abdomen.

The evidences of acute appendicitis rapidly increasing in severity decided me to operate in the presence of a pneumonia, for I believed that his chances were better without the appendix than with it. Accordingly, he was prepared for operation, and this was carried out about noon of the 30th.

The conditions about the cæcum are worthy of notice. Adhesions of long standing covered the cæcum and ascending colon, and united them firmly with the abdominal wall, the small intestines, and omentum.

After considerable difficulty the appendix was found lying posterior to the cæcum and extending upward and was removed. While liberating the appendix, a hard mass was felt in the upper part of the field. The wound in the abdominal wall was enlarged upward. The object lay deeply in the loin beneath intestines welded together by old adhesions. It was exposed, and on account of its hardness and position I imagined it to be a kidney containing a very large calculus. In freeing the kidney a soft spot on its anterior surface was torn through, and some fluid and several small whitish spherical bodies floated upward and escaped through the wound. The atrophic remains of the vessels and ureter were tied off, although I think now that there would have been little need for the ligature, as, on examining the specimen, no pervious vessels or ureter can be seen. The wound was

flushed and closed over wick and tube drainage on account of the probable infection through the escape of the cysts and fluid.

On December 31, a day after the operation, the urine was as follows: Color, reddish, turbid. Reaction, acid. Specific gravity, 1022. Albumen, a trace.

The patient's record for the ensuing days was as follows:

	Temperature.	Pulse.	Respiration.
December 31, A.M.....	99.8°	92	22
December 31, P.M.....	100.4	96	20
January 1, A.M.....	100.4	96	20
January 2, A.M.....	101.8	104	24
January 2, P.M.....	102	112	20
January 3, A.M.....	103.8	124	36
January 3, P.M.....	104	120	30
January 4, A.M.....	100.8	104	26
January 4, P.M.....	102.4	112	28
January 5, A.M., about the same.			
January 6, highest.....	102.8	112	40

The wound healed readily to the drain. This brought away bloody serum in considerable quantity. The local signs of pneumonia increased in severity. The sputum was characteristic.

He died January 7, thirteen days after entering the hospital and eight days after the operation. No autopsy was obtained, although urgently solicited.

During the operation the liver was palpated. It was not enlarged nor nodular, but seemed unusually hard.

Dr. James Ewing has kindly examined the specimen, and furnished the following report:

"The cyst measures six by four by four and one-half centimetres. Its shape is distinctly that of a contracted kidney, one-half of which is slightly larger than the other. The wall varies from one to two centimetres in thickness, and is fibrous without, lamellated towards the centre, and covered within by a finely granular parenchymatous layer. In places the lamellated portion is calcific. The cavity is composed of one large and two smaller communicating loculi, which contain a score of translucent parasitic cysts of various sizes. In the parasitic cysts there are hooklets and cholesterin crystals but no scolices, while the walls are of the usual lamellated character.

"On microscopical examination no traces of renal tissue

could be identified, the outer wall being composed of dense fibrillar connective tissue infiltrated with lymphocytes."

The photograph was taken by Dr. Bertram Buxton.

In view of the rarity of the disease, I am sorry that a post-mortem was not permitted.

As the patient was unable to speak English and no interpreter was present at the time, there is no record of the patient's previous history. However, after examination of the specimen and from a statement that he was never sick, I am disposed to think that there had been very few, if any, symptoms produced by the cyst.

The usual course of echinococcus disease of the kidney is illustrated by the following case, reported by Marsh in 1869 (Lyon's Series), which I have abstracted from the original.

Marsh, 1869. Male, aged fifty-three years. Had not felt well for several days when, on April 1, 1866, he lifted a box of fruit and felt a sharp pain in the left lumbar region, which passed off in a few hours. During the following day or two he passed bloody urine. There was more or less pain in the region of the left kidney from this time on, and he passed a little blood in the urine once or twice, but there was no special urinary trouble.

General health declined. During the first year a tumor was perceived in the left lumbar region which increased downward and forward.

Occasionally lacerating pains radiated from the spine, through the tumor, and down to the left testicle, which at one time was swollen and tender. No sexual appetite.

He was up and about until March, 1869. Diarrhœa came on and lasted several months. Thirst was urgent, but drinking increased the diarrhœa. No œdema of the extremities; no cough; no dyspnœa. Usually slept well. Patient emaciated and anæmic at time of examination.

The tumor occupied the whole of the left side of the abdominal cavity and extended two inches to the right of the median line. Ribs and abdomen protrude on the left side. Tumor smooth, with obscure fluctuation. Percussion dull, as high as fifth rib. Slight tenderness in median line and left lumbar region. Urine became scanty, and for three or four days before death there was none voided.

He died June 15, 1869. *Post-Mortem.*—Emaciation extreme. Rigor mortis marked. Intestines adherent to tumor and to each other. Dimensions of tumor after removal: Long circumference, twenty-nine and three-fourths inches; transverse circumference, thirteen inches; weight, ten pounds.

Examination showed it to be a hydatid cyst.

Echinococcus cyst. Right kidney.

Hydatid disease of the kidney is rare, especially in this country. In a comprehensive article on "Echinococcus Disease in North America," by Irving P. Lyon, of Buffalo, published in the January number of the *American Journal of Medical Sciences,* 1902, I find that in 241 cases, to which references are given, the kidney was involved only nine times, or 3.7 per cent. of all cases.

In some of these cases other organs were involved besides the kidney. In case 23, male, aged fifty-three years, the kidney alone was involved; case 34, male, aged forty-five years, the kidney; case 80, male, aged forty-three years, the kidney; case 85, female, aged fifty-two years, multiple cysts in bladder, pelvis, liver, spleen, kidney, omentum, peritoneum, diaphragm, and pericardium; case 108, male, the kidney; case 109, male, the kidney; case 143, male, aged fifty-three years, multiple cysts in lung, omentum, mesentery, subdiaphragmatic, left kidney, sac left inguinal hernia; case 181, male, aged fifty-five years, right kidney.

In the article on Hydatids of the Kidney, in Henry Morris's book on "Surgical Diseases of the Kidney and Ureter," I find a summary of cases of hydatids in all parts of the body reported by Davine, Neissen, Finsen, and Thomas, to the number of 2111. Of these 115, or 5.44 per cent., were located in the kidney, but Morris states that Gardner is inclined to believe that this percentage is much too high.

With reference to sex, Morris's cases were about evenly divided, and Lyon's show 60 per cent. males and 40 per cent. females. The age at which the disease was discovered varies from four to seventy-two years, with the maximum number between twenty and forty years of age.

When the disease is limited to the kidneys, the left is involved twice as often as the right, according to Morris; but in the cases cited by Lyon, which I have been able to trace, the right kidney was involved twice, the left once, both kidneys once.

According to the nationality of cases reported in North America, echinococcus disease is found in only 9 per cent. of

native Americans, the remaining 91 per cent. being distributed among foreign born, chiefly among those from Iceland, Germany, Italy, and England.

Etiology.—Echinococcus disease is due to the ingestion of the ova of the tænia echinococcus, a very small tapeworm having its habitat in dogs and wolves. By the action of the gastric juice the envelope of the ovum is dissolved and the embryo freed. It is then able to penetrate the coats of the stomach or intestine and be carried to other parts of the body by the blood, lymph, or by migration.

The portal system draining the digestive organs and terminating in the liver explains the frequency of hydatids of the liver—73 per cent. of all cases (Lyon).

Kermisson attributes to contusions a determining factor in locating the growth of the cyst, the contusion being attended with the extravasation of blood containing the eggs of the worm.

Wherever arrested, the ovum begins a slow growth. This is attended with the excitation of connective tissue proliferation about it producing the laminated coat by which the egg is encysted. Its growth is very slow, extending over a period of years.

Pathology.—A hydatid cyst of the kidney may be seated superficially or deeply. The characteristics of this form of growth are a smooth, tense, elastic tumor more or less spherical in shape, growing within or projecting from the kidney and varying in size from a small to a very large mass.

The cyst may be single or a typical large mother cyst enclosing numerous secondary ones. The wall varies in thickness in different places and in different cysts. It is usually tough, fibrous tissue, and shows a characteristic lamination. The kidney substance suffers from pressure and undergoes atrophy. This may be extreme, as in the specimen I present, in which all renal tissue had disappeared.

The inner wall of the cyst may be smooth or nodulated by the presence of daughter cysts, or it may be shrivelled up, or undergo calcareous or cartilaginous degenerations.

The cyst usually contains a clear fluid with a specific gravity of from 1004 to 1015. In infected cysts the contents may be pus. In some few cases the fluid has been absorbed, leaving a putty-like *débris*. In the fluid are found the scolices and hooklets upon which an absolute diagnosis rests, daughter cysts, free or attached, with crystals of various salts.

Hydatid cysts are apt to be united to adjacent structures by firm adhesions. The natural course for a hydatid cyst of the kidney is to rupture into the pelvis of the kidney, the intestine, stomach, pleura, or lung. In over two-thirds of cysts of the kidney rupture occurs into the pelvis and the cysts are discharged per urethram. There is no case on record, Roberts says, where a renal hydatid tumor has ruptured spontaneously through the flank.

Symptomatology.—There may be no symptoms where the cyst is small and rupture has not taken place, and the condition discovered only accidentally at an abdominal operation, as in my case or at the autopsy.

In other cases the symptoms are due to the size of the tumor alone or to peritonitis, if the cyst ruptures into the peritoneal cavity. If discharge takes place through the urinary tract, symptoms simulating a renal colic may be present and the daughter cysts found in the urine.

If rupture occurs into the alimentary tract, the cysts may be found mixed with the fæces. After rupture into the lung the cysts have been coughed up. The cysts may be discharged whole if small, or ruptured if large, and the scolices, hooklets, and salts found in the cyst wall.

Urine.—In this connection it should be borne in mind that hydatid cysts and *débris* have been found in the urine that came from cysts not located in the kidney, but which, being adjacent to the urinary organs, ruptured into the pelvis of the kidney—very rare—or into the bladder itself—more common. The urine is usually normal, except at the time the cyst is discharging.

The local symptoms are wanting, or may be merely a

feeling of uneasiness and weight with various grades of tenderness on pressure.

There are no constitutional symptoms unless the cyst becomes infected, and those which then ensue are due not to the cyst itself, but to the process of suppuration. Rupture of a cyst may occur spontaneously or be due to an injury. Permanent cure may follow the first discharge or escape of cysts occur at irregular intervals for many years.

Complications.—These are due to the size of the growth, rupture, or suppuration of the cyst. Rupture into the peritoneal cavity or the lung is rapidly fatal, as the fluid is very toxic. Suppuration does not occur unless the cyst ruptures or has been infected by exploratory puncture, and death will follow from septicæmia unless free drainage is provided.

Diagnosis.—This is impossible in many cases, uncertain in others, and only sure in those that rupture into the pelvis of the kidney and discharge the characteristic vesicles, scolices, or hooklets per urethram.

Among twenty-eight cases, reported by Boeckel and Houzel, submitted to operation for renal hydatids, errors in diagnosis were made in thirteen cases, uncertainty recorded in four, and a correct opinion formed in only eleven (Morris).

As the treatment depends upon the diagnosis, the following features emphasized by Morris are to be kept in mind:

The residence and association of the patient with dogs.

The insidious growth of a tumor with a smooth globular outline, with possibly fluctuation and hydatid fremitus.

The absence of pain, fever, or any change in the urine.

The situation of the tumor in the renal region with possibly a discharge of hydatids in the urine, fæces, or sputum. Following such a discharge there may be diminution in the size of the tumor.

Prognosis.—If the cyst is not interfered with, it usually results fatally from rupture, suppuration, or pressure effects on adjacent organs. A spontaneous cure has sometimes

resulted from withering or rupture. Years may be necessary for either termination.

The perils of a natural ending are so great that early surgical interference is justified in all probable cases. Roberts reports sixty-three cases, in which twenty recovered, nineteen were fatal, and the remainder unknown.

Treatment.—This can be briefly stated to be incision into the tumor and drainage. Nephrectomy has been very fatal, eight cases with seven deaths. (Morris.) Inasmuch as whatever remains of the renal tissue, not involved directly in the hydatid cyst, is able to perform its proper function, excision of the whole kidney is not justifiable, unless the entire organ is destroyed.

Incision into the kidney in sixteen cases gave sixteen recoveries. (Ibid.)

The lumbar incision is to be preferred, as then there is small danger of infecting the peritoneal cavity. After the cyst is exposed, its contents should be aspirated, the cyst wall drawn into the wound and fixed there, the wall incised, the cavity curetted, washed out, and drained freely by tube and gauze. Frequent dressings and irrigations will be followed by a gradual shrinkage of the cyst, the growth of granulation tissue, and finally its firm cicatrization.

In a few cases where the cyst is situated superficially it may be excised, the renal wound sutured, and the incision closed over a small drain.

[NOTE.—With the exception of the cases here reported, whatever information is given has been freely taken from Morris, Lyon, and the references furnished by them.]

INTESTINAL POLYPOSIS AND CARCINOMA.

By J. NIEMACK, M.D.,

OF CHARLES CITY, IOWA.

INTESTINAL polyposis is a rare disease. It has been repeatedly noticed to undergo malignant degeneration. Another interesting feature is that the disease is prone to affect a number of members in the same family. Boas ("Diseases of the Intestines," New York, 1901, page 334)[1] speaks of "heredity." The case that I am going to report seems rather to suggest a certain contagiousness, or at least family predisposition.

L. F., aged twelve years, of healthy German-American parentage, the fourth one of seven healthy children, had been well and a bright child until her ninth year, when she was taken with some obscure bowel trouble. The movements were more or less loose, mixed with mucus and blood, and were frequently attended by tenesmus and pain. Things went on this way for three years without any rectal examination.

On March 4, 1900, I saw her for the first time. She was a pale, emaciated child, with painful facial expression, size and development like nine years rather than twelve. There was continual rectal straining. The abdomen was considerably enlarged, standing out beyond the ribs; resistance and dulness were increased over the left lower quadrant. The examining finger entered easily through the half-opened anus and felt at once soft, pulpy masses obstructing the rectum. Through the proctoscope were seen large numbers of polyps of different sizes, ranging from a pea to a walnut, the pedicle of some of them so much thinned that during examination they fell off with hæmorrhage. At three different times about a hundred polyps were removed

[1] Boas gives full literature about the subject.

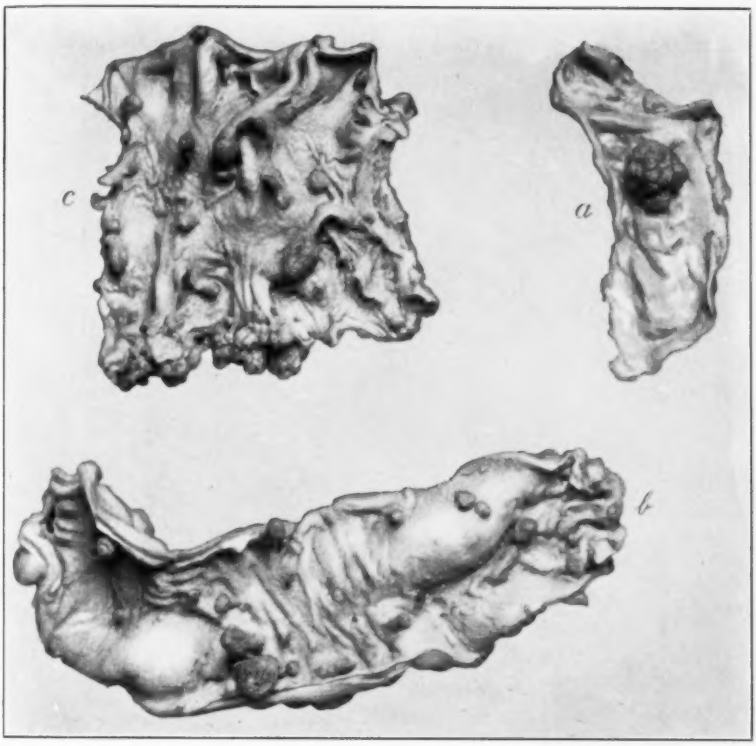

FIG. 1.—*a*, ileum; *b*, transverse colon; *c*, ascending colon.

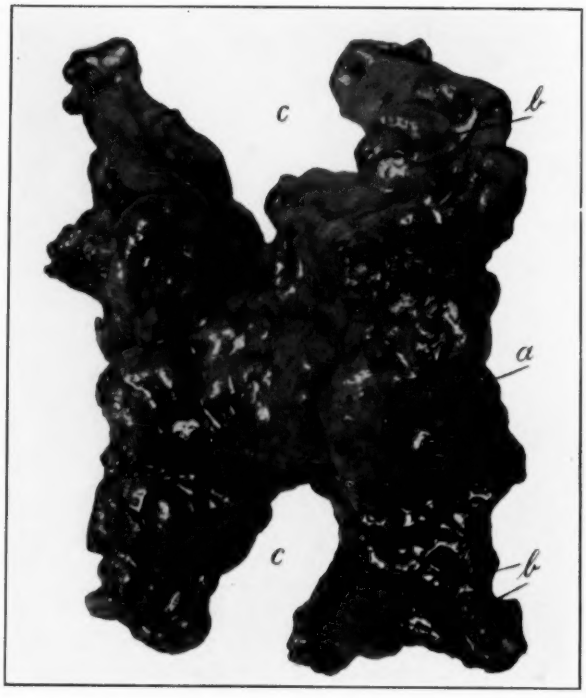

FIG. 2.—*a*, cauliflower growth one inch high; *b,b*, separate polyps. At *c* the tissue was torn away during extirpation.

with the galvanic snare. The dulness and resistance of the abdomen disappeared; it became flatter; but after having removed all the tumors as high up as twelve inches, I had to realize that beyond my reach there were a great many more. About this time there could be felt spread through the whole abdomen what seemed to be enlarged mesenterial glands. The urine continued normal, the bowel movements dysenteric and foul smelling, frequently containing necrotic polyps. Every treatment utterly failed, and on April 4 she died from emaciation.

Post-mortem examination showed general anæmia, flabby, pale heart, mesenterial glands slightly enlarged, the mucosa of colon and several inches of ileum were more or less beset with polyps (see photographs). Some of them were little nodules of pea size just standing out from the mucosa, others had pedicles up to an inch in length. The largest one, of cauliflower shape, was in the ileum. The microscopical diagnosis made by Dr. Bierring, of Iowa City, was "adenoma papillosum." The girl had never been treated with intestinal lavage before March 4.

Several months after her death, her father consulted me for rectal hæmorrhages. Remembering the case of his daughter, I at once gave him a careful examination; but the only pathological conditions found were a few hæmorrhoids, one of them cracked and bleeding quite freely. Up to about ten inches from the anus nothing else could be seen. I touched the bleeding area with persulphate of iron. He felt fairly well after that, and did not see a physician until March 24, 1902, when he came to the hospital to have his "piles" operated. Examination under chloroform and after dilatation of his sphincter revealed the fact that the lower part of the rectum down to about an inch above the anus was filled with spongy, freely bleeding masses which extended through about three inches. The rectal speculum showed a large tumor of cauliflower shape sitting broadly over the site of the prostata; higher up and around it there were several smaller pedunculated growths (see photograph). The larger tumor felt considerably indurated at the base. The symptoms had been slight tenesmus and rather painful defecation with blood and mucus. He was a man of forty-five, looking somewhat older, had been farming all his life long, had never been a very strong man, of somewhat nervous disposition, but he did not feel much weaker now than usually. He does not remember that either of

his parents had bowel trouble or malignant disease. He was unable to give any special data about the beginning of his trouble. The diagnosis of adenocarcinoma seemed well enough established to advise radical operation. This was accepted, and was performed on April 3, with the intention to remove the prostata if this gland should be found involved. The bowels had been cleaned by calomel and castor-oil for six days previous, while the diet was restricted to beef broth, eggs, and sugar. Before operation, ten drops of tincture opium were administered and the bowels thoroughly irrigated with a weak formalin solution. In consideration of the prostatic gland, I chose Hueter's incision. It is made with the patient in lithotomy position in somewhat like a horseshoe shape, with the open side towards the coccyx. A transverse incision of two inches close to the pars bulbosa urethræ penetrates at once into the subcutaneous fat. So do the two sagittal incisions, which extend on both sides of the anus about two inches and a half just beyond the posterior margin of the anus. Dissection is continued until with one gloved finger in the rectum a Cleveland ligature-carrier can be pushed all round the rectum. The carrier draws a thin strip of gauze back and the gut is tied up. Following this ligature, the left index-finger burrows its way around the rectum, and under its protection the anus is severed with scissors from the gut, and after a few more clips through the postanal tissue the skin-flap drops back.

Up to this time no attempts were made to check the bleeding, the endeavor being only to proceed with greatest speed. Now the venous bleeding was checked by hot irrigation, which was kept up during the whole further proceedings. In our case the ligature slipped off from the infiltrated stump, so it was grasped by hysterectomy forceps and pulled down. The levator ani had to be sacrificed, and several branches of the arteria hæmorrhoidalis media were cut through between ligatures after having been put on the stretch; the rest of the work was done by blunt dissection. The peritoneum was stripped off for two and a half inches to bring the healthy bowel down far enough. The diseased gut was resected well within the healthy tissue, and six silkworm-gut sutures inserted in the remaining gut and led out through the anus. These silkworm sutures were at once used to unite the small anal stump with the rectum and allowed to remain long for a while. Thin gauze strips were laid along the gut and brought

out through the two lower angles of the incision; the skin-flap was adjusted with a few silkworm stitches and sewed up with continuous catgut. Uniting anus and rectum with continuous catgut suture was greatly facilitated by using the silkworm sutures for traction. Finally, a large drainage tube wrapped up in gauze was placed in the gut and aseptic dressings applied by a "T" bandage with pressure. The whole work up to this point had taken up just two hours. Right after the operation the patient's pulse was eighty-eight and fell to sixty within the next two days; his temperature rose on the fifth day to 101° F., a little sinus having formed round one of the upper silkworm stitches. After removal of the pus the temperature became normal and stayed so throughout his recovery. The patient was kept on the above-mentioned diet and received four drops of tincture opium for six days. The gauze drains and silkworm stitches were removed on the seventh day, and the bowel washed out with a soft rubber tube introduced into the sigmoid. This lavage was done from the seventh day twice daily, while the patient received regular food. No other physic was given till the twentieth day. The movements were always formed and passed during lavage without injuring the wound. On April 26 patient left for his home with all his wounds perfectly healed; the sphincter has not yet perfectly contracted.

I have reported the proceedings rather extensively because I think that the horseshoe incision as devised by Hueter should become the operation of choice in every low-seated carcinoma in preference to the posterior incision. It is certainly a great advantage to have the blood and nerve supply of the anus and sphincter perfectly undisturbed. Drainage is easy even after the gut has been perfectly united, and while it is true that there is more plastic work at the end, this is very easily accomplished. I heartily endorse the advice given by others not to lose time in trying to check hæmorrhage before the whole operation field is laid open; the amount of blood lost in our case did certainly not reach two ounces. There were no enlarged glands palpable in our case, but I believe they could have been handled from the horseshoe incision just as well as in the usual way.

To review the features of the case: The presence of other polyps near the carcinoma suggests strongly the malignant degeneration of primarily simple papilloma. The latter disease was his daughter's fatal sickness. By the patient's first examination two years ago we have the fact ascertained that the father became affected with rectal polyps after his daughter's death. These facts would suggest a possible infectiousness of intestinal polyposis, and the difference of the ages would account for the malignant character by " intensity" in the father by " extensiveness" in the girl.

A nephew of F.'s, twenty-nine years of age, came under my care after writing down the above report. He is a young man of slim build, twenty-nine years of age, unmarried. Since two years he has suffered repeatedly from large intestinal hæmorrhages, but appears well in every other way. I had an opportunity to examine him, and found five inches above the anus two large pedunculated polyps, one smooth, the other of cauliflower shape. Over his abdomen there could be felt the same little apparently glandular indurations that were noticed in his cousin.

BONY CYSTS OF THE MIDDLE TURBINATED BODY.

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[*From the Hull Laboratory of Anatomy of the University of Chicago.*]

The occurrence of cysts having bony walls in the anterior end of the middle turbinated body has long been known. A number of such cases have been reported, and the symptoms and treatment of this condition are now well understood.

My own experience with bony cysts of the concha media or concha bullosa is limited to the following three cases.

Case I.—Mrs. L., aged fifty-nine years, complained of long-standing headache and of dryness in the nasal passages and pharynx. There was no marked hinderance to nasal respiration. A bilateral, smooth, roundish enlargement of the anterior ends of both middle turbinated bodies was found. They were both covered with a somewhat thickened mucous membrane. The largest was about the size of a small hickory-nut. A puncture showed the enlargement to consist of an empty cavity having thin bony walls.

Case II.—Mr. A., aged thirty years, had suffered for a number of years from troublesome headaches and with difficulty in breathing through the right side of the nose. A smooth, roundish tumor completely filled the right side of the nose with the exception of a small space near the floor. The septum was pushed somewhat into the left naris. The mucous membrane covering the tumor was thickened and soggy. The tumor filled the nose so completely that the snare could not be passed around it. It was easily removed in fragments with polyp forceps, and proved to be a large cyst in the anterior end of the middle turbi-

nated body. The walls were of very thin bone. The cavity was empty and lined with a thin glistening of mucous membrane. Its removal left the right nasal passage so roomy that the ostium sphenoidalis could be readily seen.

CASE III was discovered in the post-mortem room. The accompanying drawings were made from this case. The concha bullosa here extended forward into the atrium and reached to within one centimetre of the floor of the nose. The cyst had very thin bony walls, and the cavity was empty and lined with smooth mucous membrane. It measured twenty-eight millimetres long by twenty-five millimetres broad. It communicated freely with the middle meatus through a semilunar opening near its upper border. It communicated further with the frontal sinus, with a large ethmoid cell pushed into the frontal sinus, and with the ethmoid labyrinth above and behind. The cyst is clearly in this case part of the ethmoid labyrinth, and represents a greatly enlarged ethmoid cell that has developed in the anterior end of the concha media, just as the large cell in the frontal sinus is an ethmoid cell and part of the ethmoid labyrinth. Another anomaly in this case was a large ethmoid cell which communicated freely with the frontal sinus and opened into the superior meatus, and through the cyst of the concha media into the middle meatus.

These bone cysts of the concha media are, as a rule, empty air-containing cavities, but, like any of the accessory cavities of the nose, they may become involved in an inflammation. Thus the cyst sometimes becomes the seat of a mucocele or an empyema. Most of the cases reported have occurred in young women. The condition has only been found in adults.

Regarding the etiology of such cysts there has been considerable difference of opinion. Glasmacher,[1] who was one of the first to describe such a cyst, considered it as a greatly enlarged ethmoid cell with a tendency to continue gradually increasing in size, but not a pathological condition, any more than any large ethmoid cell is pathological. The view that such a cyst represents an ethmoid cell is held also by Heymann,[2] Zwillinger,[3] Meyerson,[4] Steida,[5] and Sundholm.[6]

Another view of the origin of such cysts is that advanced by Greville MacDonald.[7] He held that what he called an

"osteophytic periostitis" caused the lower free edge of the concha media to elongate and curl upon itself in such a way that the free edge was approximated along the base of the body in the middle meatus, where it became attached along the border and at the ends, forming a closed pocket. The mucous membrane of the concave surface of the concha media, which lined the pocket, continued to secrete mucus, which ultimately caused a distention of the walls of the cavity, and thus formed the concha bullosa.

A view held by Hajek corresponds quite closely with the theory of MacDonald. Hajek holds that there are two types of cystic enlargement of the concha media. One type[8] is formed by a developmental peculiarity consisting of a curling under the free edge of the concha media until it forms a cavity which communicates with the middle meatus. Such a cyst may become the seat of a mucocele[9] or an empyema.[10] The second type[11] is formed by a circumscribed dilatation of the concha media, the result of an empyema of the ethmoid labyrinth in which dilatation has taken place downward into the middle turbinated body.

Max Schaeffer[12] makes a distinction between a cystic enlargement of the middle turbinated body caused by extension downward of an empyema of the ethmoid labyrinth and what he considered a true bone cyst of the concha media, "echte Knochenblasen." This latter Schaeffer has always found filled with mucous and not associated with any further disease of the ethmoid labyrinth. He admits the possibility, however, of its being the seat of an empyema which might extend upward and involve the ethmoid labyrinth.

Zuckerkandl[13] holds the following view of the origin of the concha bullosa. The lateral concave surface of the concha media in its middle and posterior thirds forms with the outer wall of the middle meatus a cavity called the sinus of the concha media. The upper part of this sinus is often divided by bony bridges extending between its curved walls into niches which communicate freely with the chief sinus. The formation of the concha bullosa he considers the result of the exten-

sion of one or more of the pockets thus formed over into the concha media. The cyst, according to Zuckerkandl, always opens freely into the middle meatus. The cavity represents an ethmoid cell analogous to the cell that develops in the unciform process.

The mistake has sometimes been made of confusing a condition of circumscribed bone disease occasionally found involving the inferior turbinated body with the true bone cyst lined with epithelium and having thin bony walls as found in the anterior end of the concha media. Such a cyst as this has never been found in the inferior turbinated body for the reason that the concha inferior is no part of the ethmoid bone, and is never the seat of an ethmoid cell as is the concha media. A theory referred to by Knight,[14] and recently again by McKinney,[15] that the bone cysts of the nose were the result of a "rarefying ostitis" might perhaps be applied to the process that occasionally involves the concha inferior, but that a rarefying ostitis is the cause of the true bone cyst of the concha media is entirely without any evidence in fact.

That the concha bullosa represents but an enlarged ethmoid cell can scarcely be questioned. The concha media and its analogous structures, the bulla ethmoidalis and the processus uncinatus, represent but the median extension into the nasal cavity of partition plates of the ethmoid labyrinth. The bulla is usually the seat of an ethmoid cell, and it is common to find an ethmoid cell in the unciform process. In the same way, the base of the anterior end of the concha media is often occupied by an ethmoid cell. Such a cell may communicate with the ethmoid labyrinth above, or it may form according to the method described by Zuckerkandl and open alone into the middle meatus, or, as shown in one of Hajek's illustrations,[16] it may open into the superior meatus. It is the excessive development of such a cell in the concha media that produces the concha bullosa. Of the theory referred to by MacDonald, that the cavity is due to an osteophytic periostitis of the middle turbinated body, causing it to curl upon itself and thus forming the cavity, and the somewhat similar view

held by Hajek, it can only be said that such theories can never be definitely proven by the examination of cases *in vivo,* and from cases studied post-mortem there has as yet been nothing found that would uphold such a view.

FIG. 1.—Left lateral wall of the nose, showing cystic enlargement of the anterior end of the middle turbinated body (concha bullosa); also large ethmoid cell in the frontal sinus (bulla frontalis.)

To what can we attribute the enlargement of the cell of the concha media to the huge proportions of the concha bullosa, as shown in Figs. 1 and 2?

The view was formerly quite generally held that the en-

largement represented an ectasia from the pressure of inflammatory discharge occurring in a cell, the outlet of which had become closed. It can be readily understood that a rapid

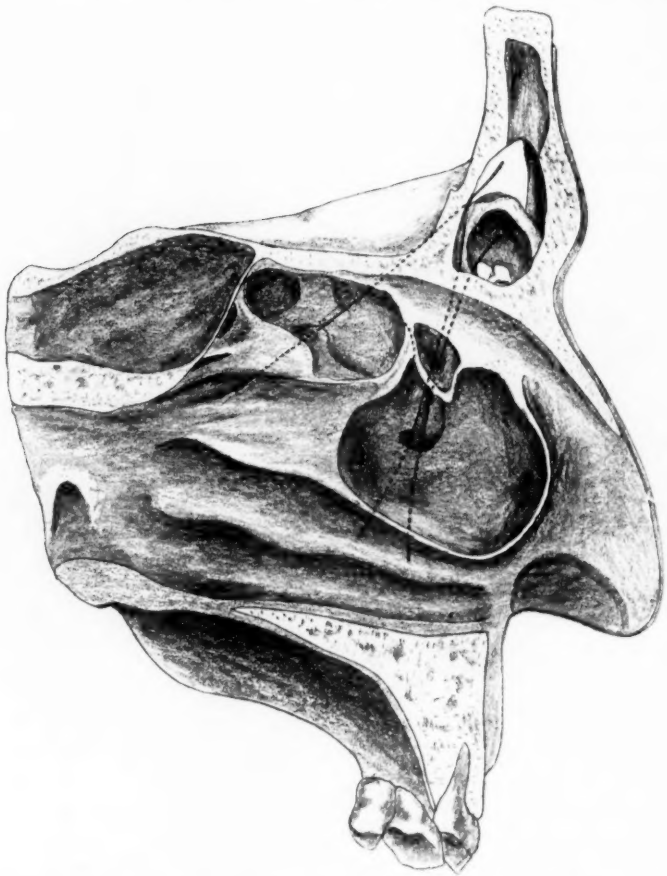

FIG. 2.—Same as Fig. 1, with median wall of concha bullosa and of the ethmoid cells removed to show free communication of the cyst of the middle turbinated body with the middle meatus of the nose, with the frontal sinus, with the large cell pushed into the frontal sinus, and with the ethmoid labyrinth above and behind.

distention of the walls of such a cell may result from an empyema of the cell as occurred in a case reported by Fraenkel.[17] Whether the inflammation is an extension downward

into the turbinated body from a disease of the ethmoid labyrinth in a case where the cell of the concha media opens into the ethmoid labyrinth, or whether the disease is limited to a cell in the concha media that does not communicate with the labyrinth above, but has its outlet into the middle or superior meatus, the process is, of course, exactly the same. The explanation that the concha bullosa always represents an ectasia from a closed inflammation cannot, however, be accepted, since these cysts are usually found empty, nor do they show any positive evidence of a past inflammatory process.

The view has been held by some that a long-standing rhinitis sets up in the walls of the cell a periostitis that produces a gradual enlargement of the cavity, but the great frequency of chronic rhinitis and the extremely rare occurrence of the enlargement of this cell makes this theory highly improbable. The existence of chronic rhinitis in the presence of a concha bullosa should be looked upon as an entirely separate condition, or, at most, possibly the result rather than the cause of the concha bullosa.

The cells of the ethmoid labyrinth show the most marked variation in their normal development. Sometimes a great many small cells, at other times only a couple of very large cells, compose the labyrinth. The ethmoid cells show a tendency to develop outside the usual limits of the labyrinth, as in the frontal sinus, the unciform process, and the anterior end of the concha media. These ethmoid cells have the same tendency as the cells of the typical labyrinth to expand occasionally into large cavities, producing the bulla frontalis or large cell in the frontal sinus and the concha bullosa or cystic enlargement of the anterior end of the concha media. The concha bullosa should be looked upon not as an inflammatory product, but as an anatomical variation, the result of a developmental anomaly. The fact that the concha bullosa has only been found in adults may possibly be explained by the fact that, like other accessory cavities of the nose, the cell of the concha media does not reach its full development in childhood.

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SUBACROMIAL DISLOCATION FROM MUSCULAR SPASM.

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THE following case is of interest partly on account of the etiology, partly on account of the long time, three months, in which the patient suffered from the deformity of a shoulder dislocation without suspecting it or seeking surgical treatment, he all the time believing that he had rheumatism of the shoulder.

The patient, a strong, muscular man, thirty-eight years of age, had always enjoyed good health, with the exception of some indigestion. On January 23, 1902, his wife woke up during the night and found him breathing heavily, with rigid muscles, eyes fixed, and grating of the teeth. The tongue was severely bitten during the attack, and there is now an extensive scar on its left side. During breakfast, next morning, he remembered nothing whatever about this attack, and wondered over his sore tongue. He consulted his family physician, Dr. C. S. Jones, during the day, complaining over dizziness, headache, the sore tongue, and lameness of his right shoulder. He had previously noted occasional attacks of a slight dizzy sensation, without loss of consciousness, which forced him to sit down for a few minutes. He ascribed these attacks to indigestion, as they, so far as he remembered, generally occurred after a heavy meal. No treatment had been used, as he otherwise felt perfectly well. Dr. Jones gave him a laxative and regulated his diet, but considered it best not to mention for the time being that he probably had had an epileptic fit. No examination was made of the shoulder.

He called on Dr. Jones again on April 18, 1902, complaining that his right shoulder still was very lame, and that he found great difficulty in dressing himself. The doctor examined him carefully, and discovered some fulness under the outer side of the spine of the scapula, with considerable atrophy of the deltoid and posterior muscles, and complete absence of motions in the

shoulder-joint. Believing he had some form of dislocation, he brought him to me for consultation. By the examination very slight changes of the contour of the shoulder were discovered, but lying down there was a great prominence of the coracoid process, with some flattening of the shoulder, with prominence of the acromion in front and fulness behind, where a rounded prominence could be felt under the posterior margin of the acromion. There was considerable atrophy of the deltoid, supraspinatus and infraspinatus muscles, and less prominence under the acromion from the tubercles of the humerus than on the left side. Movements in the shoulder-joint were completely abolished, all motions, and they were very limited, taking place between the scapula and the two joints of the clavicle. The arm was held somewhat forward and away from the body, and was rotated strongly inward. Outward rotations were impossible and the attempts painful. Recognizing a subacromial dislocation, we tried reduction under chloroform on the same day, but unsuccessfully, particularly on account of the impossibility of fixing the scapula during the attempts with the means at hand. A harness was therefore made, consisting of a broad, well-padded leather belt going around the right half of the chest, with a strap over the shoulder to keep it in place, and fastened with a rope to the wall some feet from the patient's left side. A well-padded cylinder of leather was made to surround the right humerus, the elbow being free in order to use rotations, and fastened with triple pulleys to the wall on the patient's right side. Under deep narcosis, a few days afterwards, the arm was now pulled with great force, but slowly and carefully, in an outward and upward direction, and the prominence under the posterior margin of the acromion was felt to move little by little. After strong outward rotation the prominence disappeared, and the dislocation was reduced. The arm was bandaged with a broad, adhesive plaster strap, as in fracture of the clavicle, keeping the elbow backward and the head of the humerus forward for a few days, and massage and passive motions then commenced. Under this treatment the shoulder is rapidly improving and complete recovery is expected.

The X-ray picture, taken by Dr. Pitkins, of Buffalo, with the plate behind the shoulder and five minutes' exposure, gives a fair idea about the conditions before the operation. The head of

Subacromial dislocation of the head of the humerus.

the humerus is shown pointing directly backward, the tuberculum minus occupying the glenoid cavity, and the tuberculum majus pointing forward and found directly under and behind the coracoid process. The arm is seen in abduction and rotation inward, the latter indicated by the absence of the tuberculum majus from its proper place below the acromion. The glenoid cavity of the scapula could not be felt from the front, as in cases of subspinous dislocation. It was occupied by the tuberculum minus with the tuberculum majus in front, below and behind the coracoid process.

This dislocation is considered rare. I have never seen it before, and am not aware that an X-ray picture has been taken from it before. It has frequently occurred during an epileptic fit, probably by internal rotation. Stimson states that the common mode of production is pressure backward and outward upon the head of the humerus, directly or through the elbow, combined with adduction of the limb across the front of the chest and rotation inward. Forcible rotation inward of the arm alone may produce it, as shown in experiments on the cadaver. It seems, however, difficult to understand how it can occur in a strong, muscular man lying in bed and having a severe epileptic convulsion, but with nobody restraining him!

Many years ago I had a patient with double subcoracoid dislocation, unrecognized for seven weeks. He, too, had had severe convulsions with unconsciousness resulting from an overdose of camphor and lasting several hours, but four strong men had been trying to keep him quiet on the bed and restrain his violent motions. The dislocations were overlooked simply because the idea prevailed that a fall or direct injury was necessary to produce them, and it had not entered the minds of his physicians, both dead now, that a man could dislocate his shoulders while lying in bed. The position of the head shows how the reduction can be accomplished. It is necessary to elevate the arm and pull it outward in order to disengage the tuberculum minus from the glenoid cavity. Strong outward rotation will then probably reduce the dislocation, as it did in this case.

THE RÔLE OF THE BACILLUS PROTEUS VULGARIS IN SURGERY.

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THE postulates of Koch are properly always called in requisition whenever the critical moment arrives to assign some specific *rôle* to a newly found organism, or to an organism found in a new abode; yet the arbitrary distinctions which we hold in calling a germ obligatory or facultative in its behavior towards temperature, air, and media under artificial conditions are not freely applicable when these conditions obtain in the human economy. Thus, while the typhoid bacillus is an obligatory pathogenic organism responsible for a decided symptom complex, it can at times, and that many years later, assume the faculty of producing suppurative conditions of the bones or gall-bladder without systemic typhoid manifestations. Then, again, the obligatory specific reaction of organisms becomes subsidiary in the presence of other organisms. Thus, the tubercle bacillus in the presence of the streptococcus produces a type of hectic fever; and how much more septic are diphtheria patients in whom the streptococcus has also taken a foothold. A long period held none other than the ubiquitous staphylococcus and streptococcus responsible for pus lesions, but of late years the coli bacillus occupies a foremost third place. A persistent search, if not in every case, at least in the exceptionally behaving ones, will see a larger number of bacteria responsible for the proper understanding of the variations. In this light we will judge, from what follows, to what extent we may look upon the proteus vulgaris as facultatively pathogenic for the human organism.

Proteus vulgaris and its allied forms were first discovered in decomposed meat and animal matter by Hauser;[1] and Escherich[2] found it in the meconium of infants. Foa and Bonomme[3] isolated the proteus vulgaris from the blood and viscera of two patients who succumbed from putrid infection due to intestinal obstruction. At the post-mortem the small intestine was found distended and the mesenteric veins thrombosed. Baumgarten[4] thinks that the proteus vulgaris may have aided the undoing of this patient, but the hæmorrhagic infection here encountered was merely secondary. Bordonni-Uffreduzzi[4] report the finding of the proteus vulgaris in two similar cases, and accord it a pathogenic *rôle*.

Welch[5] found the proteus vulgaris (Zenkeri) in an ovarian abscess associated with salpingitis. Thus far the occurrence of proteus vulgaris was more casual than causal.

In 1892, Jaeger[6] found a variety of proteus vulgaris (fluorescens) in the viscera of patients afflicted clinically with Weil's disease, a form of infectious icterus accompanied by enlargement of the spleen and liver with degenerative changes of both kidneys. Subsequently a small epidemic could be traced to the source of the drinking water which also harbored this organism. This encounter constituted the transition period of the proteus vulgaris from a non-obligatory pathogenic organism to that of an organism facultatively pathogenic for the human economy. Very much later Libman[7] found the bacillus proteus vulgaris in the pus from a case operated for appendicitis. The day following the patient became jaundiced, and enlargement of the liver and spleen set in, and albumen in the urine made its appearance. Within a few days these distinctive symptoms subsided, and the patient made an uneventful recovery. The existence of an infectious icterus dependent on proteus vulgaris was recalled to my mind when the following case, forthwith to be narrated, presented itself.

Male, aged twenty-seven years, resident of Paterson, a silk factory hand, had been ill for three days with severe pain in the

side of the head, face, and neck, accompanied by severe chills and fever each day with marked prostration. The intense pain and difficulty in deglutition he sought to have relieved. His appearance was that of a very sick man, jaundiced sclera and skin, with intense itching of the latter. Temperature (rectal), 102° F.; pulse, 112; spleen enlarged; liver slightly so; glands on the left side of the neck along the sternomastoid enlarged. The saliva dribbled from his mouth and the speech was heavy. Oral inspection: The left half of the tongue was swollen, more so in its posterior half, very elastic and tender. The sublingual area was œdematous. Under local cocaine anæsthesia the surface was seared with the Paquelin, and the abscess aspirated with an all-glass syringe (sterilized). The pus obtained was utilized for cover-glass preparations and for inoculations upon culture media (agar). The abscess was then opened and a drachm of pus evacuated. Drainage with a wick of iodoform gauze. Within five days the abscess cavity went on to complete healing, at the expiration of which time the jaundice had wholly disappeared and the swelling of the liver and spleen were no longer perceptible.

Bacteriology.—The cover-glass preparations showed short bacilli and a few short-chained streptococci. The agar tube, after twelve hours in the thermostat, presented a smeary growth. Cover-glass slips from this showed the same short bacillus and isolated long-chained streptococcus. This growth was then plated, the bacilli isolated, and its behavior towards the various media noted. The bacilli were of variable length, about the size of the bacterium termo, in the main slightly rounded ends, and often arranged in parallel chains. The best conception of their configuration can be gained from impression preparations (*klatsch-preparat*). The bacilli retained the color when stained according to Gram. Bouillon is slightly clouded and a scum forms on the surface. A hanging drop from this showed a very active motility. On slant agar the surface has a honey-combed appearance, and the growth is very luxuriant. Stab gelatin (10 per cent.) is liquefied at a room temperature within thirty-six hours, and has a horseshoe-nail appearance. Inoculation on a slant of gelatin shows the liquefaction extending in different directions. Plate cultures on 5 per cent. gelatin brought the features of swarming islands into prominence. The accompany-

ing illustrations will more clearly convey the appearance of the germ's growth. The color of litmus milk was changed, but no coagulation occurred. All of the cultures emitted an offensive odor.

Inoculation.—A loopful of the growth from the twenty-four-

FIG. 1.—Cover-glass impression from plate (Zeiss, one-twelfth immersion).

hour agar culture, second generation, was inoculated into two white mice at the root of the tail subcutaneously. After twenty-four hours the mice looked very ill, and within thirty-six hours they died. At the site of inoculation a scant amount of pus was found, and extending from here into the much-enlarged regional

FIG. 2.—Colonies before liquefying (Zeiss, AA).

lymph-glands there were numerous hæmorrhages. The spleen was very much enlarged and the liver slightly so. Cultures from these organs showed the bacillus again, though they were scantily present in both the cover-slips and cultures made from the viscera, and with difficulty found in but a few of the sections of

the viscera. Histologically the study of the viscera showed a degeneration of the cells of the liver, more so than the kidney. In the spleen the follicles were enlarged.

FIG. 3.—Colony showing swarming islands (Zeiss, DD).

Thus biologically this bacillus conforms to the proteus vulgaris. In support of the claims of a proteus infection, the following reported cases are submitted.

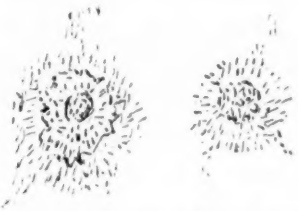

FIG. 4.—Plate colony (Zeiss, AA).

Hauser [8] found the proteus vulgaris in a putrid phlegmon of a student who had punctured his finger while working on the cadaver. Within twenty-four hours great œdema and swelling set in. Temperature, 39° C. The impression of the case was one of a phlegmonous erysipelas. Five days later the fever returned, the forearm became swollen, calling for extensive incisions. These abscesses emitted a very putrid, gaseous odor, and for thirty-six days later the pus retained this odor. Furthermore, the granulations looked so poor that tuberculosis was suspected because of the slight rise of the evening temperature. The pus evacuated showed streptococci and termo-like bacilli, which latter by culture proved to be proteus vulgaris.

Brunner [9] reports a similar case from which he isolated the proteus vulgaris. A boy had punctured his finger beneath the finger-nail; four days later the thumb became swollen and the hand very œdematous. No lymphangitis or lymphadenitis. Temperature, 37.6° C. Incision under ether spray with the evacuation of bad-smelling, hæmorrhagic pus and necrotic tissue. From this the proteus vulgaris was isolated from the other accompanying organisms, streptococci and staphylococci.

Karlinski [10] found the proteus vulgaris in an ulcer of the leg and in the pus from a pelvic abscess originating from a post-puerperal endometritis.

Bernacchi [11] discovered the proteus vulgaris in an old osteomyelitis with a long-standing fistulous opening.

Pfaundler [12] reports the case of a girl originally afflicted with infectious icterus (Weil's disease). On the fourteenth day of the disease a periostitis of the jaw set in, from which the proteus vulgaris was obtained in pure culture.

Charrin [13] publishes a case of fœtid, purulent pleurisy in a woman who, aborting at eight months, became septic on the seventeenth day, and subsequently died. In the pus obtained from the empyema (operated) a pure culture of proteus vulgaris was gained.

Kuhnau [14] found the gangrene in diphtheria cases to be severe when the proteus vulgaris was present, and similarly the putrid empyema in phthisical patients was traceable to the presence of the proteus vulgaris.

Of all the encounters of the proteus vulgaris, perhaps that of Schnitzler [15] has the most direct bearing on the significance of this organism in surgery. He says that it, of all bacteria, alone, without any other factors, is capable of producing cystitis.

Krogius [16] simultaneously and independently made the same observation. The latter says that the clinical course of the cystitis in the presence of the proteus vulgaris was in every instance very severe. Krogius reports a lethal exit in two instances, and once he found the proteus vulgaris in the blood a few hours before death.

Then Wreden,[17] studying the cause of cystitis, showed that tampons saturated with pure cultures of proteus vulgaris inserted into the rectum previously irritated with diluted small quantities of croton oil caused a cystitis by migration of the bacteria along

the lymph channels into the bladder. He also suggests that the same explanation suffices to account for the occurrence of cystitis in uterine carcinoma and in infected conditions of the endometrium.

Melchior [18] in turn substantiates the foregoing regarding the production of cystitis by the proteus vulgaris. He says that the proteus vulgaris is the only bacillus which, introduced into the normally functionating, healthy bladder, without the co-operation of any contributing factor, is capable of producing cystitis. This he explains by virtue of the extraordinary rapidity with which the bacillus causes ammoniacal decomposition of the urine as quickly as it accumulates preliminary to evacuation. In ten instances Melchior found this bacillus in pure culture. They were all very severe forms of cystitis.

Neumann [19] secured the proteus vulgaris from the blood of the heart, spleen, and kidneys of a patient who for years had incontinence of the bowels and bladder due to paralysis. This speaks, says Neumann, for the facultative parasitic characteristics of this organism. The principal focus in this case was a cystitis starting from the rectum.

Tavel and Lanz [20] isolated the proteus vulgaris from a case of peritonitis that died from an incarcerated hernia two days after operation from paralysis of the bowel.

Flexner [21] establishes some claim for the proteus vulgaris as causative of peritonitis. He cites the case of a girl aged eighteen years who succumbed to peritonitis. At the post-mortem there were found mainly a chronic diffused nephritis, pleuritis, pyosalpingitis. The intestinal follicles were swollen and a tubercular ulcer noted in the ileum. From the fibrinoplastic peritonitis the proteus vulgaris was obtained. The case originally was one of ascites due to Bright's disease. Flexner points to this as a contributing cause favoring the invasion of the proteus vulgaris, which statement is concurred in by Welch at the discussion.

Grossman [22] narrates a case of perityphlitis that became jaundiced, and from the pus obtained at the operation he isolated the proteus vulgaris. He also recounts a like case in which the proteus vulgaris was associated with the bacillus coli. These are similar to Libman's case mentioned above.

Finally, Ohlmacher [23] encountered the proteus together with staphylococcus and streptococcus in a fatal case of cerebellar

abscess and leptomeningitis following middle ear disease. He quotes Malinchini, who also reported a similar case of meningitis consequent upon a necrosis of the temporal bone after otitis media.

Every investigator who has encountered this micro-organism has always entertained the question of its bearing towards the disease with which it was associated; and just this question concerns the practical surgeon. The conspicuous citations passed in review will convince us that even if an outspoken attribute cannot be assigned to the proteus vulgaris, it nevertheless assumes at times a dominant characteristic to both influence the local and systemic conditions.

Originally found in decomposed animal matter, it is not at all far-fetched to find its most characteristic action in the instances of peritonitis and pleurisy cited which had their origin in decomposing placental remains. Likewise easy of explanation are the peritonitides originating from lesions in the intestinal tract. The fœtid cystitis in women appearing post-puerperally is thus easy of interpretation; and, on the other hand, the fœtid cystitis in males can be explained on a tolerably well-accepted theory of the wandering of this organism, a fairly constant inhabitant of the bowel, into the bladder, when urinary stasis exists. Its presence in the ulcer of a leg and in the sinus of the old osteomyelitis, I think, are merely instances of implantation from the anal region, as is so frequently seen in infants and persons of unclean habits in the case of the bacillus pyocyaneus, which so often discolors the pus in wounds of the lower extremities. Most frequently proteus vulgaris is an annoying saprophyte. W. Cheyne [24] puts it down as ever saprophytic. In this claim he is only supported by Baumgarten. Arrayed against these two are all the other observers, whose consensus of opinion is that it, in conjunction with other organisms (symbiosis), assumes a pathogenic significance, either enhancing or supplementing their action. The streptococcus is the most frequent companion of the proteus. In culture media the proteus rapidly over-

grows the streptococci, and furthermore Monti [25] has shown that streptococci lose their virulence as well as their pus-producing capabilities if toxic products of the proteus are simultaneously inoculated into the animals. Hauser corroborates this, wherefore the proteus is so often found in peritonitis, septic endometritis, and eventually in the peritonitis emanating from this. This symbiosis Hauser pictures as follows: The streptococcus causes necrosis. This dead matter favors the growth of the proteus vulgaris, and the latter's poisons in turn impair the resistance of the tissues, which altered vitality again is favorable for the growth of the streptococci. The clinical picture set up by Weil, and elaborated by Jaeger's studies, is thus far the classical expression of the proteus infection or intoxication. The proteus is not capable of producing a primary infection; it only steps to the fore after the bacteria of invasion have rendered effete the living organic matter, then the toxins that have been found in the bodies of the proteus vulgaris (Meyerhof [26]) intoxicate the system.

In conclusion, recurring to my case which inspired this inquiry, I am of the opinion that here, too, the proteus is a secondary infection, and only because of the encountered icterus and enlarged liver and spleen it assumed a pathologic *rôle*. I do not believe it to be either a metastatic deposit or a primary source for the infection. I picture the infection as follows: The streptococcus so diminished the resistance of the body that the proteus, of greater virulence than ordinarily, acted as in Weil's disease as pointed out by Jaeger. Then followed an implantation or invasion of the proteus into the abscess from its habitat in the mouth as a part of the gastro-intestinal tract. Pfaundler's case I likewise think is merely an infection per continuity and not a metastatic abscess.

A befitting conclusion to this summary of these instances of proteus infection is the estimate placed on this organism by Welch,[27] who says, "Although repeatedly observed in inflammations of exposed surfaces in appendicitis, in peritonitis, and even in closed abscesses, in association with other bacteria, it has been generally considered to be non-pathogenic for man;

but our autopsy material has convinced us that it may be pathogenic. It may be unassociated with other bacteria in abscesses and in peritonitis, and it may cause general infection by invading the blood and internal organs."

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TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, March 12, 1902.

The President, L. W. Hotchkiss, M.D., in the Chair.

AMPUTATION OF THIGH FOR GANGRENE OF LEG WITH SUPPURATING INFARCT IN A CHILD FOUR WEEKS OF AGE.

Dr. Forbes Hawkes presented a male infant, two months old. The parents were apparently healthy, gave no history of specific trouble, and there were no manifestations pointing to that disease. There was no injury at birth: the presentation was cephalic, and no instruments were used nor excessive manipulation necessary. When the child was two weeks of age, a small spot of gangrene appeared in the big toe of the right foot; it gradually spread, and in the course of two weeks the limb became gangrenous up to the knee.

When Dr. Hawkes first saw the patient, two weeks after the onset of the symptoms, a lump was made out in the popliteal space just above the line of demarcation, which was first thought to be a sarcoma. Under chloroform, the limb was amputated through the lower third of the thigh. The wound healed perfectly and without any undue formation of granulation tissue. The specimen was sent to Dr. Thatcher for examination; he came to the conclusion that the mass which had apparently obstructed the circulation was not a sarcoma, but that it consisted of an infarction, with secondary inflammation.

Dr. C. L. Gibson said that possibly the infarct was secondary to some pulmonary disturbance, which would easily be overlooked in so young an infant. The speaker said that in two cases of obstruction of the popliteal artery which had come under his observation, in both instances the source of the trouble was attributed to a pulmonic condition.

Dr. Hawkes said that the child had apparently been entirely

well up to the time when the gangrene of the toes appeared. It had had no fever nor vomiting; it was not a "blue" baby, and there were no evidences of any cardiac lesion. He entertained the idea that there might have been some congenital abnormality of the popliteal artery. Dr. Merrill, who had been in attendance at the time of labor, and constantly afterwards, had assured him that there could not have been any constriction from the infant's clothing. There had been no spell of crying at any time.

SUPPURATING GUMMA OF THE LIVER.

Dr. Howard Lilienthal presented a man, thirty-six years old, who first came under his observation on December 11, 1901. He gave a history of syphilis, for which he had been treated for a few weeks with potassium iodide, not with mercury. Three years ago he was obliged to spend ten days in bed on account of a pain in the right abdomen, which was regarded as due to indigestion. From that time on the pain had recurred every few months, each attack lasting longer than its predecessor. It was usually located in the right hypochondrium, and extended down below the ribs. It was particularly marked when he took a long breath, or upon rising from a sitting posture, or when he made any movement involving the muscles below the waist. There was slight tenderness in the region referred to. The liver was considerably enlarged, and could be quite plainly felt through the tense rectus. There was a slight temperature elevation.

An operation was done on December 24, 1901, the diagnosis resting between suppurating cholecystitis and some trouble in the liver, possibly a gumma. The incision revealed a mass in the right lobe of the liver, near its edge, which felt boggy at the centre and was evidently softened in that location. The gall-bladder was apparently normal, and no other mass could be felt in any other part of the bladder. Upon cutting into this mass, a focus of pus was found. The entire mass was removed with a sharp spoon, and the condition was immediately recognized as a suppurating gumma of the liver, and confirmed by microscopic examination. The wound was sutured and drained, and the patient left the hospital on January 16 of the present year with a slight sinus at one point. This sinus resisted the usual methods of treatment, including curettage, but was finally induced to close by the following procedure: A folded bandage was laid over the

rectus muscle and fastened in place with adhesive strips; a firm binder was then applied, so as to press the walls of the sinus together, leaving out all drainage. By this method the sinus closed in two days.

The patient was at once given energetic antisyphilitic treatment, and he is enjoying excellent health at the present time. From the day after the operation he was able to take a long breath without pain, and he has had no abdominal symptoms since.

COLLOID CARCINOMA OF THE OMENTUM.

DR. B. FARQUHAR CURTIS presented a man, thirty-five years old, who was admitted to Bellevue Hospital in June, 1900. He was then suffering from extreme ascites, which was supposed to be due to cirrhosis of the liver. He had never been tapped, and he was referred from the medical to the surgical side of the hospital for the purpose of establishing an anastomosis between the liver and omentum. An exploratory laparotomy revealed a mass lying across the abdomen, evidently made up of omentum. A small portion of it was removed and sent to the pathologist, who reported that it was colloid carcinoma. Nothing more than this exploratory operation was done, but in consequence of it the ascites disappeared, and the patient's symptoms were entirely relieved until very recently. There has been no apparent change in the size of the abdominal neoplasm.

DR. GIBSON referred to the question of the malignancy of colloid cancer of the abdomen. It is supposed to be extremely malignant, but Dr. Curtis's case does not seem to bear out that theory; and the speaker said that in a case of his own, which he had operated on some seven months ago, the patient, instead of doing badly, is doing remarkably well.

DR. HOTCHKISS said that about a year ago he had operated for what was supposed to be an inflammatory disease of the appendages of the uterus. Upon opening the abdominal cavity, several hard plaques were found upon the surface of the sigmoid colon, and the pelvis was filled with a dense growth which constricted the gut. The condition was such that he excised a considerable section of the colon, forming an artificial anus, and closing the distal end of gut. The section of gut with growth was submitted to the pathologist, who pronounced it a sarcoma. The subsequent history of this case was rather remarkable. The

divided ends of the gut became involved in a severe wound infection, and in the course of time the proximal end sloughed into the closed distal segment, so that the fæcal current was partially re-established. At the end of a year the patient returned, and requested to have her artificial anus entirely closed. Rather against his inclinations Dr. Hotchkiss again opened the abdomen, freed the two divided ends of the gut, and brought them together with a Murphy button. At this operation the condition in the lower abdomen was found to be entirely different from what it was at the primary operation. Instead of the original dense pelvic growth, there were several small apparently glandular masses in the sigmoid mesocolon. Portions from these, which were very soft, were removed and sent to the laboratory, and the pathologist reported that they were doubtful sarcomata. In both instances the examinations were made by a competent pathologist. Whether the character of growth had changed and the tumor partially disappeared, as a result of the severe infection, or the original diagnosis was wrong, is a question. The patient in the meantime has recovered and gone to work.

GASTROSTOMY.

Dr. Howard Lilienthal presented a man, aged forty years, with a malignant stricture of the œsophagus, thirteen inches from the teeth-line. Gastrostomy was done on October 8, 1901, under eucaine locally and a few whiffs of chloroform. The operation was done as follows: After splitting the rectus fibres, a cone of the stomach was drawn out through the wound and fastened to the peritoneum and posterior fascia of the abdominal parietes. It was then incised and a tube inserted at the apex of the cone; this was fastened with ligatures, and the cone pushed back into the stomach and plugged up with gauze, which was left in.

This operation, Dr. Lilienthal said, is practically the same as the Kader operation, minus the stitches. It is very simple, can be rapidly done, and in two cases where he employed it, it worked extremely well. It is a slight modification of the method proposed, but never practised, by the late Dr. Hall, formerly of this city.

TUBERCULAR TENOSYNOVITIS.

Dr. Arthur L. Fisk presented a woman of forty, who came under his observation in December last with a tenosynovitis of the left wrist and hand. Over a year ago she noticed a slight

swelling first at the inner side of the wrist, which gradually grew in size. Some six months later this extended beneath the annular ligament into the palm, first along the flexors of the first finger, and later along those of the third and fourth fingers. The palm became so swollen that the functions of the hand were lost. On palpation, distinct fluctuation was obtained between the swellings in the palm and those above the wrist, and rice bodies were plainly felt. Incisions were made in the lines of the flexors of the first, third, and fourth fingers in the palm as high as the annular ligament; and above this two incisions, one anteriorly, the other internally into the flexor sheaths, both superficial and deep. Quantities of rice bodies were removed, all larger than a melon seed. The sheaths of the tendons were very much thickened, matted together, and showed tubercular deposits. Excision of these sheaths would have necessitated virtually a complete dissection of the palm of the hand, which seemed too radical a procedure to begin with; therefore the rice bodies were all carefully removed, the tubercular areas gently and thoroughly eroded, and then the sheaths irrigated through and through with a solution of tincture iodine one drachm to water Oi, at a temperature of 110° F. The incisions were left open and packed with iodoform gauze. At each dressing the iodine solution was used only, and the wounds repacked with iodoform gauze. Union was by granulation without any suppuration, and the hand is well, except for the small granulating spot. There is still limitation of function, which time and use will overcome. The value of iodine solutions in this case has been most striking; the rapid and excellent result is largely due to their use. The method pursued is attended with less risk of permanent injury to the hand than where the sheaths are dissected out, and the ultimate result promises to be most satisfactory.

Dr. Theodore Dunham said that about ten years ago he had a case of tuberculosis of the extensor tendons of the index-finger in which very satisfactory results followed the use of iodoform. The phalanges of the thumb had been so badly involved that amputation was necessary. The amputation wound healed readily. About six weeks later the man again presented himself with a swelling over the tendons of the index-finger on the dorsum of the hand and wrist. An incision revealed a fungous condition of the tendon-sheath, the tendon itself appearing inflamed and

congested through the mass of granulations. Instead of making a thorough excision of these granulations, which would probably have resulted in crippling the hand, Dr. Dunham inserted a drainage tube into the tendon-sheath, fastened it there, and then, after sewing up the wound, he injected into the sheath a 10 per cent. emulsion of iodoform and glycerin. This injection was repeated every two or three days for about six weeks, the tendon-sheath being thoroughly ballooned up at each treatment. As a result of this treatment, all the swelling disappeared, and the restoration of function and appearance was perfect. Four years subsequently, when Dr. Dunham last saw him, no signs of a recurrence could be found.

Dr. Lilienthal said that Dr. Fisk's case called to mind two that had come under his observation. The first occurred in Dr. Gerster's practice, probably sixteen years ago. The patient was a medical student with a diffuse tenosynovitis, of tubercular origin, involving the dorsal structures of one hand and the palmar structures of the other. Dr. Gerster dissected out, as well as he could, all the tubercular tissue. The young man made a perfect recovery, and is now practising medicine in this city. The wound healed by primary union. This case is reported by Dr. Gerster in his book.

Ten years ago, Dr. Lilienthal said, he had a case in which the tendon-sheath of the little finger and that of the thumb, together with the bursa in the wrist, were affected. The rice bodies could be plainly felt. He made four incisions and evacuated a large number of these melon-seed bodies, and then treated the case by frequent injections of iodoform-glycerin emulsion. The patient made a perfect recovery, without deformity or disability.

Dr. Lilienthal said that he did not consider those cases in which the dorsum of the hand is affected in the same class with those occurring in the palm of the hand, because, even if things go wrong in the treatment of the former class of cases, the usefulness of the hand is not likely to be impaired; at least, not to a great degree. The speaker said he considered the open operation a safer method of treatment than any other. The injections of iodine or iodoform-glycerin emulsion are made with the view of effecting a cure by granulation, and it is possible that they may produce secondary contractions. The wide-open operation, under the strictest precautions, is the most worthy of trial.

DR. WILLY MEYER said he had treated two cases of tuberculosis of the sheaths of the extensor tendons and large bursæ of the hands. One of the patients was a woman, the other a man. Both cases were bilateral, and the treatment was the same in each, namely, total extirpation of the sheaths of the tendons. The operation was comparatively easy, primary union followed, and within a few weeks the patients had fairly good use of the fingers. The speaker said he saw one of these patients, a working-woman, several years subsequent to the operation, and found that she had perfect use of her hands, and there were no signs of a recurrence. She had been presented before the Surgical Society.

Dr. Meyer said he agreed with Dr. Lilienthal in preferring free incision and extirpation to the use of iodine or iodoform emulsion.

DR. ELLSWORTH ELIOT, JR., said that while he also considered the free excision of tuberculous tissue under aseptic precautions preferable to the use of iodine in these cases, yet there are a certain group of cases in which this procedure cannot be carried out. The tuberculous tissue may not be limited to the sheaths, but may involve the tendons themselves; and it would be necessary to sacrifice them in order to excise all of the diseased tissue. The speaker said that one such case coming under his observation was treated by partial excision followed by injections of iodoform emulsion, with the result that the remaining tumefaction entirely disappeared. Complete excision in that case would have necessitated removal of all the tendons of the flexor sublimis and one or two of those of the flexor profundus. In these cases, nature is often kindly disposed in her reparative process, and healing takes place, as it does in tubercular peritonitis.

DR. FISK inquired whether in any of the cases referred to by the speakers the process had extended above the wrist. In his own case the disease was quite extensive above the wrist, and it would have been necessary to cut through the annular ligament and make a very wide dissection. As it was, he carefully removed as much of the tuberculous tissue as possible with the curette, and then used the iodine solution. The outcome is certainly very satisfactory.

DR. LILIENTHAL said that in both the cases he had referred

to the disease had extended above the wrist. His own case, which he treated by injections of iodoform emulsion, took much longer to cure than the one treated by Dr. Gerster by free incision and extirpation. In the latter case, he did not recollect whether Dr. Gerster cut through the annular ligament of the wrist, or whether he manipulated the hand so as to remove as much as possible of the diseased tissue without cutting through that structure. Of course we all recognize, the speaker said, that it is not possible to remove every vestige of tuberculous tissue.

Dr. Meyer said that in both his cases the disease extended from the middle of the dorsal surface of the hand to the middle of the forearm, and the annular ligament was freely divided.

CHRONIC LARYNGEAL STENOSIS.

Dr. John Rogers presented a child, four years of age, that had diphtheria in September, 1900, and during its attack the larynx became involved, necessitating intubation. Subsequently, when an attempt was made to remove the tube, it was found that the child could not breathe without it. This condition persisted, and she was referred to Dr. Rogers in December. Attempts were made to overcome the difficulty by the insertion of the largest size ordinary tube which the larynx would admit and leaving it in place for periods of from six weeks to two months. Only slight improvement resulted. A special tube was then made and inserted for six weeks. After this period, or in January last, it was found that the stenosis was entirely cured. There is no cough, and the voice is returning.

These cases of chronic laryngeal stenosis following intubation in diphtheria, the speaker said, are not of infrequent occurrence. This was the sixth case that he had been able to cure by this method of treatment. The tube should be as large as the larynx will admit, and remain in place at least six weeks. If after a second six weeks the stenosis persists, a cure can always be obtained by increasing the transverse diameter of the neck of the tube. This special tube should have the length and head of the ordinary one suitable for the age and development of the child; but the retaining swell must be as large as will pass the cricoid with some little force. The neck is then made with a transverse diameter of three-thirty-seconds of an inch less than the retaining swell.

Dr. Francis J. Quinlan said many of these obstinate cases of laryngeal stenosis were post-diphtheritic in origin, while others are of a catarrhal type, and in the latter class of cases the symptoms of stenosis are often paroxysmal in character and are excited by pathological changes in the lymphoid structures of the fauces and rhinopharynx. Dr. Quinlan said he had seen a number of cases in which the laryngeal spasm was entirely relieved by the removal of hypertrophied tonsils and clearing out the lymphoid tissues in the upper respiratory tract. Surgeons are often inclined to overlook these lesions that excite by reflected action many symptoms in the trachea and simulate organic strictures by their symptoms.

Dr. Rogers, in response to a question, said he did not think these patients should be pronounced cured until at least a month had elapsed after removal of the tube. Relapses are common within a few days or a week. One of his cases has gone four years without a relapse. In another one of his cured cases absolute stenosis had lasted for two years.

OSTEOSARCOMA OF THE FIBULA IN A CHILD THREE YEARS OF AGE.

Dr. Royal Whitman presented a child, three years of age. Swelling of the child's leg, in the region of the right ankle, was first noticed last July. This increased slowly, and in December the child was taken to a hospital, where an incision was made along the outer aspect of the leg, apparently on the supposition that the disease was tuberculous. No pus was evacuated, and the swelling continued to increase slowly, although unaccompanied by pain or any particular disability.

The diagnosis of osteosarcoma was later confirmed by histological examination.

INTERSCAPULO-THORACIC AMPUTATION FOR SARCOMA.

Dr. Ellsworth Eliot, Jr., presented a man, forty-five years old, a native of Denmark, and an engineer by occupation. His mother died of tuberculosis; otherwise, his family history is negative. He denies gonorrhœa and syphilis, and is moderately addicted to the use of alcoholics, chiefly beer. He had diphtheria in childhood. His right elbow was dislocated when he was six-

teen years old and was never properly reduced, resulting in imperfect function, although the limb remained fairly useful.

Five years ago, while exercising with dumb-bells, he felt his right shoulder snap, as if thrown out of joint. Although it was stiff and moderately painful, he did not see a doctor. Since then backward and upward movement of the arm has been limited. Six months later he noticed a swelling, about the size of half an egg and rather soft in consistency, over the acromion process. He does not recollect whether it was movable with the skin or not. Aching pain and stiffness of the joint were occasionally noticed, influenced by the weather, as in rheumatism. No apparent growth or change in consistency took place in the tumor till about one year ago, when it began to grow more and more rapidly. About four months ago, while making a sudden movement, the shoulder seemed thrown out of joint, projecting outward and growing suddenly larger. Since then the pain has been worse and the size more variable. The patient believes that when the arm is at rest the swelling diminishes and grows softer temporarily. At the time of the patient's admission to the hospital, on January 25, 1902, he complained that the pain had been quite severe; he described it as sharp and stinging in character, shooting down the arm to the hand. Motion and sensation were not affected.

Upon examination, the right shoulder was found to be much enlarged. Over its outer upper aspect there was a hemispherical mass, three and one-half inches in diameter, over which the skin was tense, and of a mottled, deep red color. This part of the mass seemed elastic, but no distinct fluid wave could be made out. The circumference of the affected shoulder was much increased, being about six inches larger than that of the opposite side. The superficial veins were much dilated. The patient had fair use of the arm, but was unable to abduct it far from the body. He had perfect control of the forearm. Rotation of the humerus was impossible, but this did not seem to be due to bony ankylosis.

On January 29, 1902, Dr. Eliot did an interscapulo-thoracic amputation. An incision was made along the anterior surface of the clavicle, from the sternoclavicular articulation to the junction of the middle and outer thirds, and carried down to the bone. The clavicular attachments of the sternomastoid, pectoralis major, and subclavian muscles having been divided, the clavicle was

disarticulated at the sterno-articular joint and rotated outward. The dissection having been carried down to the subclavian vessels, the artery was cut between two silk ligatures, and then the same was done with the vein between catgut ligatures. A second incision was then made from the middle of the first downward and outward, anterior to the groove between the pectoralis major and deltoid, to the junction of the anterior axillary fold with the arm, thence backward to the posterior axillary fold across the inner surface of the arm. The flap having been dissected up for a short distance, the pectoralis major and minor were divided near their insertions. The teres major and latissimus dorsi were then divided in the line of the incision and the thoracic portion of the axilla cleaned out. The brachial plexus having been divided, the patient was turned over on his left side and the incision continued upward and inward to a point over the middle of the spine of the scapula, thence downward at an acute angle to the lower angle of the scapula. The next incision passed from the posterior end of the first over the shoulder and down along the vertebral border of the scapula to the angle, meeting the preceding at an acute angle. The scapular attachments of the various muscles having been divided, the arm was removed. Bleeding points having been secured by catgut ligatures, an opening for drainage was made at the lowest portion of the posterior flap, and the skin was closed with continuous silk sutures. The patient's general condition remained good throughout the entire operation.

The patient recovered from the operation with no nausea or vomiting. The following morning there were no signs of shock excepting a nervous tremor. For the first thirty-six hours he complained of severe pain in the three outer fingers of the amputated hand; there was also moderate pain in the region of the former inferior angle of the scapula. His mental condition was normal. The patient's recovery was uneventful, and he was allowed to sit up in bed on the fifth day.

A microscopic examination of the growth shows that it is practically a form of sarcoma, although its exact nature is still undetermined. The pathologists incline to the opinion that it is a perithelioma.

DR. LILIENTHAL said he had had occasion to look up the subject of perithelioma, and pathologists had informed him that

whenever we find this type of new growth in any part of the body, it is very apt to be secondary to a primary tumor of the suprarenal bodies or of the kidney itself. If the diagnosis is correct, a recurrence is almost certain to take place. It may recur in the liver or in the bones, the latter being a favorite site.

CHOLECYSTOTOMY FOR CHOLECYSTITIS.

Dr. Eliot also presented a man, twenty-seven years old, who was first treated at the Presbyterian Hospital about a year ago. He gave no alcoholic nor venereal history, and had been practically well until four months previous to the date of his admission. Then he began to suffer from sharp, cramp-like pains in the region of the epigastrium, which seemed to radiate laterally. Following these acute attacks there would be more or less dull, aching pain in the epigastric median line, resembling that caused by a bruise. The acute attacks first occurred about twice monthly, but were becoming more severe and frequent. On several occasions, according to the patient's statement, they had been followed by jaundice, which lasted only a few hours. He has had diarrhœa at times, and the act of defecation often seems to aggravate or bring on an attack of the cramp-like pains, which are then relieved by the passage of fæces and gas. Pain sometimes causes nausea, but never vomiting. He lost about thirty pounds in weight within three months, and was obliged to give up his work.

Cholecystotomy was done by Dr. Eliot on April 10, 1901. An incision was made one inch below and parallel to the right free border of the ribs from the outward border of the right rectus muscle, four inches long, extended by a vertical incision to the border of the ribs. After dividing the sheath of the rectus and retracting the muscle, it was possible to palpate the cystic and common ducts and view the free border of the gastrohepatic ligament. No stone nor constriction was found. The gall-bladder was distended, and gentle pressure failed to reduce the distention. A needle was introduced and one ounce of thick, dark-brown fluid obtained. Two silk retention sutures were introduced into the fundus of the bladder and an incision made between them, the escaping bile being sponged away. No stone was found, and the wall of the bladder was not much thickened, but

considerably inflamed. The gall-bladder was drained and the wound closed.

The patient's convalescence was uninterrupted. He rapidly gained in flesh and strength and has been free from pain since the operation. The case was evidently one of inflammatory cholecystitis, with pains simulating biliary colic.

Dr. Willy Meyer said the surgeon is sometimes disappointed, in operating for gall trouble, to find a cholecystitis and nothing more. This has occurred twice in his own experience. In one of them, profound jaundice persisted for many months, and there were distinct attacks of gall-stone colic. An operation revealed no gall-stones, but a thickening of the head of the pancreas. The patient recovered with a fistula, which persisted for several weeks and then closed permanently. The second case was operated on very recently. The patient was a man who had suffered from repeated attacks of gall-stone colic, with jaundice. The gall-bladder was thickened, and contained pus, but no stone. Probably small stones had passed into the duodenum and not been found in the stool.

Dr. Eliot said he knew of the case of a young medical student who had an impacted calculus in the cystic duct; and two years ago he operated on a man about thirty years old with calculi in the cystic duct and a beaded condition of the duct itself, which indicated that the stones must have existed for years before the onset of severe symptoms.

Dr. Eliot said he thought it was quite possible to have an inflammation of the gall-bladder without the presence of stones. Such a condition may exist in other organs of the body; and he saw no reason why we should not have an inflammation of the mucous membrane of the gall-bladder.

Dr. Lilienthal said he had met with two cases of gall-bladder disease in children, one in a child of six years, which was reported in a recent volume of the *International Clinics,* and the other in a girl eleven years old, who was operated on very recently, and whose case will be reported in full later. She had suffered from biliary colic with gall-stones, and was cured by cholecystectomy.

Dr. Gibson said that while gall-stones occur with comparative frequency in young women, they are uncommon in young men. Very recently he saw a young man of twenty-two whose

gall-bladder was removed on account of gall-stones. Most surgeons have come to look upon gall-stones as not an essential feature of cholecystitis, but simply as the probable cause.

DR. HOTCHKISS said he had seen a boy of nineteen with a gangrenous gall-bladder containing stones.

The fact mentioned by Dr. Gibson, namely, that gall-stones are not necessarily an essential feature of gall-bladder inflammation, has been well demonstrated by Dr. Lartigau in his experiments on animals, wherein he proves clearly the fact that the stones themselves are the result of bacterial infection, and also that certain forms of cholecystitis occur which are due to infection through the portal blood stream, and in which gall-stones never have been present.

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, March 3, 1902.

The President, RICHARD H. HARTE, M.D., in the Chair.

FRACTURE OF THE PATELLA TREATED BY WIRING.

DR. W. L. RODMAN presented a man, forty years of age, who had sustained a fracture of the patella ten weeks ago. The patella was wired simply by placing the wire through the fibro-aponeurotic covering of the bone instead of drilling the bone. The joint was found to be full of blood-clots. It was thoroughly irrigated with normal salt solution and the wire introduced through the periosteum covering the fragments, which were widely separated and turned down, so that good results would have been impossible by non-operative treatment. Recovery was uneventful, and the temperature was never more than 99.5° F. There had been no resentment in the joint. As a precaution to prevent refracture of the bone, he is wearing an apparatus at the present time. Wiring was done two days after fracture.

DR. H. R. WHARTON expressed the opinion that there was not bony union between the fragments. He thought, however, the result would be a very good one, and the separation of the fragments would be limited by the presence of the wire. He had never used the silver wire in the aponeurotic structures, but rather favored the method of Stimson, of bringing the aponeurotic structures together with catgut and then closing the wound as Dr. Rodman had done. He thought the question of wiring the patella was still on trial. He saw very excellent results by the older methods of treatment, by simply fixing with posterior splints, compresses, and adhesive strips. Either this method of wiring the bone or suturing the aponeurotic structures with

catgut is better than Barker's method, which consists of passing a heavy silk suture around the patella. The latter method leaves a foreign body in the knee-joint, and does not get rid of blood-clots or inverted or torn aponeurotic tissues which may be inverted between the edges of the bone.

Dr. John H. Gibbon favored the semicircular incision for turning up a flap to expose the patella.

Dr. De Forest Willard recently had an unfortunate experience. The man had suffered a simultaneous fracture of both patellæ from muscular action. The fragments were encircled subcutaneously by loops of silk, and drawn closely together. The case progressed without the slightest evidence of joint infection. He let him up at the ninth week with apparently good union. The second day, while on his crutches, he slipped, and in endeavoring to catch himself pulled the fragments in each patella half an inch apart. He remembered another case in which he did not wire; and yet there seemed to be bony union,—the skiagraph also showed complete union,—and yet the man on using the limb pulled the fragments half an inch apart.

Dr. Rodman said that he had used the curved incision in his previous operations on the patella. Like Dr. Wharton, he much preferred the direct suture rather than the subcutaneous suture of Barker and others. There is certainly less danger of infection and better results are to be procured. As to the statement of Dr. Wharton regarding ligamentous union, he did not think there was motion. He did think union was pretty close; certainly closer than it would have been without direct suture. Wiring fractured patellæ is possibly still *sub judice*. It was his conviction that in good subjects who are to lead an active life, it should be given the preference over other and less satisfactory methods of treatment. He had had no bad results.

FRACTURE OF THE CLAVICLE ASSOCIATED WITH ANEURISM OF THE SUBCLAVIAN ARTERY.

Dr. R. H. Harte presented a fracture of the clavicle associated with aneurism of the subclavian artery. The history of the case is briefly as follows: The patient about a year ago noticed at the root of his neck a large swelling, which was pulsating and of considerable size. He did not seek any medical advice for its relief. While descending a flight of stairs he tripped and fell,

striking on his shoulder and breaking his clavicle, and when admitted to the Episcopal Hospital in November last, the speaker found a large pulsating expansile mass corresponding to the position of the subclavian artery, and directly over that, and lost to a certain extent in the surrounding swelling, were the two ends of a fractured clavicle. On auscultation all physical signs of an aneurism were evident. Shortly after admission there was considerable ecchymosis around the seat of injury, and the pulsation and bruit, with a well-marked radial pulse, still continued. In about four days after the receipt of the injury attention was called to the fact that the pulsation had entirely ceased in the region of the injury, and it was found that this was correct, leading to the belief that a clot had formed, which was apparent by the increased density of the tumor. The patient was kept absolutely at rest in bed, and no attempt was made to apply any surgical dressing to correct the deformity in the clavicle other than to keep him on his back with a small sand bag resting on his shoulder. All evidences of pulsation now have disappeared, leaving only a clavicle united with some deformity. The speaker was inclined to regard this as a case of aneurism which had been cured in some way by the traumatism received.

OLD DISLOCATION OF THE SHOULDER.

Dr. Harte also presented a man of seventy-three years, who had presented himself at the Pennsylvania Hospital a few weeks ago with all the characteristic signs of an old subcoracoid dislocation. He felt quite positive that it would be impossible to reduce it without doing damage to either the bone or more particularly to some of the important blood-vessels or nerve-trunks. He therefore did a resection of the entire head of the bone by splitting the deltoid. The patient at no time complained of any discomfort, and in a week was up and around the ward with the wound entirely healed. He had been always strongly of the feeling that this is much the safer way of dealing with old dislocations of the head of the humerus, rather than attempting to resort to force in correcting the deformity, which is always accompanied with a certain amount of risk, especially in old people. The results that he had obtained by excising the head of the bone had been much more satisfactory, and the function of the joint is restored much quicker than if the head of the bone is forcibly

replaced and retained for a long time in an apparatus to insure its remaining in its normal articulating surface.

Dr. O. H. Allis agreed with Dr. Harte that efforts to reduce old dislocations, even if the head is placed in the better position, often result in ankylosis and a useless and painful joint. In this instance, the man's arm will be getting better and better and the flail-motion in the shoulder-joint become, under proper exercise, gradually more accurate.

Dr. John H. Gibbon spoke of the danger resulting from attempts at reduction in these old luxations. He had broken the humerus by attempting to reduce it by the Kocher method. He had seen two other fractures of the humerus by attempts at reduction. All the cases were of long standing. This method works all right in fresh dislocations, but in old dislocations is apt to produce a fracture.

LIVER ABSCESS, PROBABLY OF AMŒBIC ORIGIN.

Dr. John H. Gibbon presented a man who four and a half years ago went to South Africa and followed the occupation of peddler. After a residence there of two years, he developed a form of diarrhœa which he said was very prevalent at that time among the foreigners. It was characterized by frequent and bloody stools, loss of flesh, very little pain, and no loss of appetite. At the end of three years he determined to leave South Africa, and began to improve as soon as he set sail. This improvement continued after his arrival in this country until about three months before admission to the hospital, the latter part of September, 1901, when he suffered from a return of bloody stools, and was treated in the medical dispensary of the Polyclinic Hospital by Dr. Cohen. Under treatment the blood entirely disappeared from the stools and the patient improved in health. About a year before coming to the hospital he noticed a swelling in the upper portion of the right side of the abdomen, which has continued to gradually enlarge. During his attendance at the dispensary his stools were repeatedly examined for the amœbæ, but none were found. At the time of admission it was found that the patient's liver was enormously enlarged, particularly the anterior portion; so much so, in fact, that the lower ribs were displaced upward. The patient's temperature was below 100° F.;

his pulse was not rapid; he suffered from no localized pain, had no sweats, and complained of little discomfort. The leucocyte count was about 10,000. At this time it was thought that crepitation could be felt over the tumor. The patient stated that before coming to the hospital a doctor had introduced a needle and withdrawn some brown fluid. Dr. Gibbon made an incision into the abdomen over the most prominent part of the tumor, which was at the costal border on a level with the tenth rib. When the peritoneum was opened, he found the liver extending nearly down to the crest of the ileum and very generally enlarged. There was, however, at the point of greatest prominence a sense of fluctuation, and into this portion he introduced an aspirating-needle, withdrawing a very thick, dark pus. There were no adhesions between the liver and the intestines or the omentum. The upper surface of the liver, however, was slightly adherent over the point of fluctuation to the diaphragm. The opening into the liver made by the needle was enlarged by means of the Paquelin cautery until a large-sized glass drainage tube could be introduced. Through this tube there flowed an enormous quantity of very thick, dark pus. The exact quantity he was unable to estimate because of the necessity for constant irrigation with salt solution in order to protect the peritoneal cavity, which had before puncture been walled off with abdominal pads. The quantity of pus, however, exceeded the largest quantity that he had ever seen removed from the pleural cavity. As the liver contracted, he saw that he would be unable to drain the abscess through the incision which he had made, and found it necessary to make another incision at right angles to the first and running backward towards the loin. Through the lower angle of this transverse incision he was able to establish very satisfactory drainage by means of a rubber tube and gauze packing. This operation was done in the early part of October. The patient improved rapidly after the operation, the amount of drainage gradually growing less until about two weeks ago, when it ceased entirely. The contraction of the liver was at first slow, but lately has been very rapid, until now it has reached about its normal size. The wound is entirely healed, and the patient suffers no discomfort. The pus was examined for the amœba, but the examination was negative. He was sorry that he did not scrape the abscess wall, because often the amœbæ can be found in the

scrapings when they are not found in the pus itself. During the man's stay in the hospital his stools were also frequently examined for amœbæ, but on each occasion with a negative result. The diagnosis in this case was somewhat obscure; and, although the speaker had carefully weighed the question of liver abscess, he rather inclined to the view that the condition was a suppurating hydatid cyst. The patient's history of long-standing diarrhœa accompanied by blood in the stools becoming better and worse alternately was in favor of abscess; but, on the other hand, the long duration of the swelling (more than a year), the absence of all symptoms of pus, and the absence of amœbæ in the stools, together with the fact that occasionally crepitation was heard over the growth, led him to believe that he would find upon opening the abdomen an hydatid cyst. The discharge in the abscess cavity was carefully examined for hooklets, but none were found. The patient has now returned to his work, feels perfectly well, and has gained a great deal in weight.

SURGERY OF THE KIDNEY.

Dr. John B. Deaver read a paper with the above title, for which see page 87.

Dr. J. Chalmers Da Costa was in accord with Dr. Deaver's view that stitches should not be put in the kidney. He believed stitches to be inadequate and dangerous. In making an attempt on one occasion to find out how much resistance there is in the kidney structure, he found that the stitch would tear with the very slighest traction. Any stitch that goes through the kidney substance must be loose before the wound in the skin has been closed.

He was in favor of the gauze-packing, and had used it habitually for a number of months. He had had an opportunity a few months ago to open the abdomen of a patient on whom this operation had been done. He had operated on the man a year before for a dislocated kidney. The kidney was replaced and gauze was used. The abdomen was opened because of another trouble, and it was found possible to palpate the kidney, and he was gratified with the fixation. He had lost a case from uræmia in which there was apparently no kidney disease antecedent, in which there was no complication, and in which the operation was completed as rapidly as usual. It raises the question as to

whether these operations are quite as safe as we previously thought they were.

Dr. W. L. Rodman was fully in accord with the position taken by Dr. Deaver and subsequently reinforced by Dr. Da Costa. He had had no untoward result in the gauze-packing operation, and had been gratified, in the majority of instances, to see that the removal of the gauze packing was not so painful as many have claimed. One advantage of the Senn operation is that the work is done from behind. The kidney substance is not interfered with; there is no danger of extravasation, and there is a firm cicatricial band which adequately holds the kidney in position.

Dr. H. R. Wharton, in speaking of pyonephrosis, said that his experience had been that in a large proportion of cases the kidney is converted into a large pus-tumor with firm adhesions, and that there is a certain amount of danger in removing it at a primary operation. He had lost a case of this kind a few years ago from hæmorrhage in removing such a kidney; and since that time he had followed the plan of Weir, who strongly advocates first drainage, and then, in a week or ten days, enlarging the wound and doing a nephrectomy. By drainage the tumor shrinks, and the operation is done with less difficulty. As a matter of safety, it should be considered in nephrectomy for pyonephrosis.

Dr. Richard H. Harte was convinced that the X-ray in renal surgery and in other conditions is a Will-o'-the-wisp which is liable to lead many astray. He did not wish to state that it is of no service at all; but it is dangerous to depend too much upon it before making a diagnosis. He had seen many mistakes made where too much confidence had been placed upon its shadows for the diagnosis of renal calculi or other conditions. He felt that the anterior incision is a poor way to attack the kidney, and is very often accompanied with a great deal of risk. In regard to the fixation of the kidney, he had tried a number of methods,—the so-called Senn by packing, and also the Edebohls's operation. They all are open to certain defects. Feeling that possibly some other method might be devised for retaining the kidney in position, he had tried to support the kidney in a small basket made of chromicized gut, after the kidney had been exposed, and then closing the wound with this network of catgut supporting the

kidney in relation with the posterior abdominal wall. This enabled him to close the wound, and at the same time to retain the kidney in its normal position. It may be said that with this method of procedure undue pressure may be made upon certain portions of the kidney and cause ulceration; but of course this has to be carefully guarded against by the amount of pressure in tying the sutures which form the net-work or cradle in which the kidney is supported. The results that he had obtained by this method of treatment were quite satisfactory; but he did not know that they were any better than had been obtained by the so-called Senn operation, except that it relieves the patient of a good deal of pain when the gauze has to be removed. It has, however, the advantage that the wound can be permanently closed, and that there is little chance for the kidney to slip away and assume a false position.

Dr. Deaver agreed with Dr. Da Costa's point relative to the suture cutting out of the kidney. He did not know that he had really modified Senn's operation. He practised delivery of the kidney and stripping off the fatty capsule. In the Senn operation only the posterior portion of the fatty capsule is cut away, the anterior part being pushed into the wound. In the Edebohls's operation the entire fatty capsule is cut away. In the speaker's opinion, the kidney being delivered on the surface of the back, a piece of gauze is placed under either pole. This piece of gauze comes in contact with the pelvis of the ureter. Pieces of gauze are then packed around the kidney.

OSTEOPLASTIC REDUCTION OF THE SKULL BY MEANS OF A NEW TREPHINE.

Dr. John Chalmers Da Costa read a paper with the above title, for which see page 76.

Dr. William J. Taylor was firmly convinced that the ordinary use of the chisel and mallet increases very materially the dangers in making these large flaps. The continual hammering increases the shock, and he was sure that any method which will relieve this is a distinct gain.

He now had a dental engine with which he was practising on skulls. He found that the oftener he used it the greater dexterity he acquired. No one should ever use a dental engine unless they have worked considerably on the dead body with it. He had

seen one case die from the use of the dental engine, entirely from faulty technique.

VAGINAL HYSTERECTOMY FOLLOWED BY DRY GANGRENE OF THE RIGHT FOREARM.

Dr. William J. Taylor reported a complication which had occurred in a case of vaginal hysterectomy, and which he had never before seen. The patient was a woman, aged fifty-nine years, sent by Dr. S. Mason McCollin, who entered the Orthopædic Hospital on November 21, 1901, for the relief of a complete prolapsus of the uterus, associated with a badly lacerated perineum.

Physical examination showed her heart-sounds muffled, slightly accentuated second sound. The lungs normal. The urine showed the presence of a small amount of albumen, but no casts and no sugar. There was a very slight œdema of the lower extremities.

She was kept in bed, the uterus replaced with tampon, and hot-water douches given for nearly a week (until December 4), when vaginal hysterectomy was performed. This was only difficult owing to the small size of the pelvis, it being impossible to get three fingers into the bony outlet. The uterus was separated easily from the bladder and rectum and the vessels ligated with silk, there being no occasion for the use of clamps.

Everything went on very well until the ninth day, when she had a sudden fall of temperature to subnormal, with rapid pulse and enlarged abdomen. This suggested some form of internal hæmorrhage. In a short time she reacted, but for some days there was distention of the abdomen and great tenderness, and evidently a local infection. Soon a foul-smelling discharge came from the vagina as an evidence of it. At the time of operation, the speaker could detect that the right ovary was somewhat enlarged and possibly cystic, but her abdomen was so fat and the pelvic outlet so small that it was impossible for him to make a satisfactory examination, and it is, therefore, a surmise on his part.

By the tenth day she was somewhat improved, and on the twelfth very distinctly improved in all of her symptoms, except that now there occurred a sudden loss of power and fall of temperature in the right forearm with total loss of radial pulse. This

was accompanied by intense pain in the upper forearm, and by the next day there was loss of ulnar pulse. The hand gradually became discolored, fingers blue, and by the sixteenth there was distinct dry gangrene with a line of demarcation well shown. Her general condition fluctuated,—some days rather better than others,—there being a discharge of pus from the vagina until January 7, when there began an area of moisture around the upper edge of this heretofore dry gangrene.

On January 9 she was given ether with oxygen and the arm amputated through its middle third by a circular flap.

Recovery after amputation was very rapid. The wound healed throughout very promptly, save at the inner angle, where there was a superficial slough about an inch long by one-half inch wide. For some time she had intense pain in the nerves of the arm and complained of great cramp as it were in the amputated hand. She had one or two attacks of depression with very rapid and weak pulse, generally following some digestive disturbance; but with this exception her progress towards recovery was uneventful, and finally she returned home able to walk around with comfort and feeling quite well.

Vaginal hysterectomy has always seemed to the speaker to be non-surgical, since much of the work has to be done in the dark, with great liability to local infection. This seemed to him a very suitable case for vaginal hysterectomy, for the uterus was hanging between the legs, and all of the manipulations could be done practically outside of the patient. If this condition of infection were due at all to the right ovary, which was supposed to be cystic, abdominal hysterectomy would have given an opportunity for perfect investigation and proper treatment of it. This complication might have arisen very readily before this, but he had been fortunate enough never to have met with such a condition.

An examination of the arm after amputation showed a complete clogging of almost all of the vessels, and just above the elbow was quite a considerable abscess which had burrowed down towards the gangrenous area.

TRANSACTIONS OF THE CHICAGO SURGICAL SOCIETY.

Stated Meeting, March 5, 1902.

ALEXANDER HUGH FERGUSON, M.D., in the Chair.

THREE HUNDRED AND TWENTY-EIGHT OPERATIONS UPON THE GALL-BLADDER AND BILE PASSAGES.

DR. WM. J. MAYO read a paper with the above title, for which see page 732 of June number of ANNALS OF SURGERY.

INDICATIONS FOR THE SURGICAL TREATMENT OF GALL-STONES.

DR. ARTHUR DEAN BEVAN said that in considering the indications for surgical intervention one should take a judicial position. He could not agree with such advanced surgeons as Winiwarter and Richardson, or with those surgeons who say that whenever a diagnosis of gall-stones is made, a surgical operation is indicated. He could not agree with that statement because of his analysis of post-mortem cases. In his own dissecting-room material he had 16 per cent. of gall-stone cases during a large number of years, and he thought, as a general proposition, it would be safe to say that from 8 to 10 per cent. of the adult population in most communities had gall-stones. Taking this approximate statement, it at once led to the conclusion that a great number of cases were instances in which the gall-stones were innocuous. There were, on the other hand, a great many cases where the individuals suffered little inconvenience from a single attack of gall-stones, and of the entire population this group of cases would be a considerable number. With our knowledge of the causation of the symptoms in gall-stones, he did not think it would be fair to urge operation in all cases manifesting slight symptoms.

In discussing the surgical indications one must keep in mind the causes. He was willing to accept the statement that a great majority of the symptoms are not produced by mechanical causes, pure and simple, but from infections, and that these infections occur either indirectly or directly from the intestinal tract. This explained the great value of the Carlsbad treatment, the olive oil treatment, or other forms of treatment which were used. However, he thought that no form of treatment really could dissolve gall-stones *in situ,* but continued Carlsbad treatment was of value in preventing repeated attacks of infection from the intestinal tract, and that therefore it was rational and to be advocated in a large number of cases. To-day, however, with the very brilliant results that had been obtained by surgical treatment, with the very low mortality resulting from it in expert hands, the indications for operation were much wider than they ever had been.

He thus summarized his idea of the surgical indications:

(1) Cases in which there is obstruction of the cystic duct, either the direct or indirect result of gall-stones, demand surgical intervention.

(2) Cases where there is obstruction as the direct or indirect result of continuous or intermittent attacks demand surgical intervention.

(3) Cases where there is perforative inflammation of any part of the bile tracts, including the gall-bladder, demand surgical intervention.

This left a large group of cases where there were no symptoms of obstruction of either the cystic or common duct, or a perforative inflammation, but symptoms in the majority of cases of gall-stones remaining in the gall-bladder. In a considerable group of cases the stones still remain in the gall-bladder without a typical picture of gall-stone colic. Such patients visit for years physician after physician, and many of the cases have been diagnosed as dyspepsia or gastric neuralgia, and the patients are chronic invalids. Medical men are beginning to recognize this group of cases and recommending surgical intervention. Another group of cases is where the patients have gall-stones, probably recognized, but in whom the attacks are infrequent. These cases require the combined judgment of the internist and of the surgeon as to the desirability of surgical intervention.

REAL AND APPARENT RECURRENCES AFTER GALL-STONE OPERATIONS.

DR. E. WYLLYS ANDREWS discussed this phase of the subject. Do gall-stones ever reproduce themselves after operation? Or, Does the removal of gall-stones fail to cure the patient who has them? These were two very different questions, and might require opposite answers. He thought now he believed less in stone reproduction than formerly. What he expected to find, now that his experience was much greater, was not often new stones in the bladder or ducts, but old ones purposely or accidentally left, or else kinking of the cystic duct, stenosis from carcinoma, adhesions, or other mechanical cause for hydrops of the gall-bladder. But of apparent recurrences, numerous instances did occur. They had come to him from nearly every surgeon hereabout. He had no doubt cases he thought cured which had gone to other men, and he had seen recurrences of pain under his own continuous observation. Formerly he thought and taught that gall-stones would reproduce *a priori*, as urinary bladder and kidney calculi were known to do so, and, as a large percentage of well people had gall-stones, this would seem probable. After reading the careful and positive statements of Courvoisier, Riedel, Kehr, and others, he searched carefully in his records, and could not find one unmistakable case of stone reproduction, *i.e.*, one in which an overlooked stone, ulcer, or cancer of the gall tracts, old adhesions, or some other cause might not explain the recurrence of symptoms. These writers, particularly Kehr, attempted to ridicule the idea of stone reproduction after operation, and Kehr states that many foolish things are said by physicians and patients on this subject. He declares it laughable what troubles are classed as recurrence of gall-stones, and makes fun of those who think that a gall-stone operation should insure the patient against colic after eating sauer-kraut, intercostal neuralgia, and the pain of enteroptosis or wandering kidney. This seemed like a partisan attitude; still, he defines very exactly what a return of gall-stones really is as distinguished from a return of symptoms, and this very positive statement based on so large a number of cases must command respect. Riedel says that gall-stone reproduction does not occur because the drainage cures the gall-bladder inflammation and stops their formation. Even if a few

are left, they come out on the dressings. Dr. Andrews thought this was bad teaching if it led to superficial work. It was the exact opposite of what Dr. Fenger's example would lead to. It also took no account of choledochus stones, which never would come out if left alone. Riedel also states that he has operated twelve years on gall-stones, and never had a real reproduction of stones. Kehr in one thousand cases of his own and Riedel had no proved case of reproduction. He thinks gall-stone reproduction is an occurrence usually which takes place once in a lifetime. The speaker bowed to such authorities as these, but insisted that the apparent or symptomatic recurrences were far more rare.

Leaving out of account diseases of neighboring parts, such as the kidney, ureter, cæcum, or appendix, all of which might give pain like hepatic colic, there was quite a list of postoperative troubles of the gall tracts themselves which surgeons were powerless to prevent, and which might defeat all efforts at relief. Among these were adhesions to viscera and anterior wall; hernia in drainage scar; cholecystitis, still uncured; stones accidentally left, and stones knowingly left. Stones were very unsatisfactorily felt when the gall-bladder was not opened. Those surgeons who did the two-step operation often knew very little of how many should come out later. There always would be a few cases to be operated on in the most conservative and rapid manner, and with a minimum of anæsthetic or local anæsthesia. The aim in doing an incomplete operation was to relieve the cholæmia, and later complete the operation. Stones intentionally left were not recurrences; stones accidentally left were, it was to be hoped, less common than at first. He would state it as his observation that this had occurred oftener in the past than the rose-colored views of some operators would lead one to think. As he looked back on his earliest work, before the common duct operation was elaborated by Fenger, he could think of several cases lost through inefficient search, and the now discredited idea of crushing stones through the duct wall. Some of these continued to have jaundice after the gall-bladder had been cleared of numerous stones. Naunyn was less certain than Kehr and Riedel, but thought that stones may reform. Hermann reports a case operated upon by Körte, which had a return of jaundice and colic, and was cured by Carlsbad treatment.

It was unfair to demand more of surgeons than a good

majority of cures. Internists with the Carlsbad cure only succeeded in reducing the stones to a quiescent or sleeping state. We did not in any operation get a uniform series of cures. This was true of kidney work, operations on the uterus and appendages, or on the appendix, but this did not discredit the operation. The only thing which could discredit any operation was a failure to report bad as well as good results, so that false statistics gained currency.

The treatment of complications causing recurrence of gall-stone symptoms was often satisfactory from a surgical standpoint. An overlooked carcinoma might be detected at a later exploration. Stones purposely or accidentally allowed to remain might be taken out after the patient had been built up by drainage. Adherent bands might be divided to release the gall-bladder, but broad adhesions were difficult to remove. A puncture might be made in a bladder once drained through the old adhesion with little or no danger. Finally, cholecystectomy, as advised by William J. Mayo, Löbker, Kehr, Langenbeck, and Körte, was an admirable cure for some of the unpleasant sequelæ of gall-stone work.

Dr. William J. Mayo, in closing the discussion, said he would like to call attention to one fact upon which his paper was based, namely, that uncomplicated cases of gall-stone disease gave a very small mortality; that it was the complications that produced the mortality; that most of the cases that had complications with increased mortality and with increased difficulty attending operation had had symptoms sufficiently marked long before, so that they might have been operated on at a more opportune time. This led to but one conclusion, that, instead of waiting or delaying operation, if some of the cases that came under his immediate observation had been operated earlier, complications might have been avoided. Considering the low mortality of early operations, he believed that it would only be a short time when internists would send their cases of gall-stone disease to surgeons as promptly as they do now their cases of chronic appendicitis.

REVIEWS OF BOOKS.

DISEASES OF WOMEN: A MANUAL OF GYNÆCOLOGY. By F. H. DAVENPORT, A.B., M.D., Assistant Professor of Gynæcology, Harvard Medical School. Fourth Edition. Philadelphia: Lea Brothers & Co., 1902.

The object of this work has been to give the student clearly, but with sufficient detail, the methods of examination and the simple forms of treatment of the most common diseases of the female pelvic organs; and also to help the general practitioner to understand and treat the gynæcological cases that he meets in his every-day practice.

The author has not gone into general discussions, and for the sake of brevity and clearness the treatment is mainly confined to such measures as have been found by the author to have served him the best. The minor points in gynæcology, which are usually not found in the larger text-books, are not slighted. The author describes and explains much that is of value, but which the larger books take for granted the reader knows. He has aimed to be practical, and has succeeded in making a book which abundantly fulfills his best intentions. The work is for this reason devoted largely to diagnosis and treatment.

The author has added in this edition chiefly the surgical features of gynæcological treatment, of which the previous editions contained but little.

JAMES P. WARBASSE.

INTESTINAL OBSTRUCTION DUE TO GALL-STONES.

REPORT OF THREE CASES, WITH SUMMARY OF FIVE MORE CASES FROM THE RECORDS OF THE LONDON HOSPITAL, 1893-1901.

By H. L. BARNARD, M.S. (Lond.), F.R.C.S.,

OF LONDON,

ASSISTANT SURGEON TO THE LONDON HOSPITAL.

Case I.—R. F., a married woman, aged thirty-seven years, was sent up to the London Hospital on January 13, 1901, by Dr. MacDonnell, of Stoke Newington, with a diagnosis of intestinal obstruction and the following history. Until nine months ago she had enjoyed very good health. She had never suffered from biliary colic or jaundice, nor had she any previous attack of intestinal obstruction. For nine months before admission to the hospital, she had, however, suffered from an aching pain in the right side of the abdomen, which prevented her from lying on that side. This pain was at times so severe as to make her feel sick. On Wednesday, January 9, 1901, she was suddenly seized with a "griping" pain in the right side of the abdomen below the ribs. On Thursday, January 10, 1901, she took a purge, and her bowels were opened several times on Friday, but the pain was not relieved. From this time she had absolute constipation,—neither fæces nor flatus were passed,—but she suffered from tenesmus. Vomiting commenced on Saturday, January 12, 1901. It was incessant, profuse, and from the very commencement brown in color, and smelled of fæces. The patient and her husband volunteered the statement that "she was passing her motions from her mouth." She was in great pain and in a condition of severe prostration.

On admission to the hospital the abdomen was found to be flaccid and neither distended nor tender on palpation. The pulse was 100 per minute and of fair volume and tension. The tongue

was dry and covered with white fur. The patient complained of great thirst, and about an hour after admission vomited dark, feculent-smelling matter. Per vaginam a mass, which was taken to be fæcal, was felt in the situation of Douglas's pouch. On examining the rectum it was found to contain some fæces, and the same hard mass could be felt above and in front.

Treatment.—Three enemata, containing turpentine, one ounce, in soap and water a pint, were given at intervals of about a couple of hours. The first brought away a little fæcal matter. The other two were without any result either of fæces or flatus, and the hard mass could still be felt from the rectum. The vomiting was now more urgent and the patient's general condition had not improved.

Operation.—The abdomen was opened by the usual median laparotomy incision below the umbilicus. A coil of congested and distended small gut projected. The inner aspect of the hernial rings and the umbilicus were then explored with the hand and found to be normal. The cæcum and appendix were examined. The former was found empty and contracted. The empty coil of ileum entering it was drawn out of the wound and rapidly followed up. At a distance of about five feet from the ileocæcal valve the gut was found to contain an ovoid, hard mass, which was recognized as a gall-stone. The gut was empty and contracted to a very small lumen below the stone, whilst above it was greatly distended and congested. The sudden narrowing of the gut formed a kind of septum, on which the stone rested and blocked the narrow orifice left. The coil of gut containing the stone was delivered out of the wound and packed round with sponges. It was then emptied of fæcal matter and clamped above and below. A short incision was made in the length of the gut and the stone squeezed out. The incision was then closed by a continuous suture of No. 1 silk, through the peritoneum muscle and mucous membrane, as the mucous membrane was too thin to be sewn separately. The wound was invaginated by interrupted Lembert sutures. The gut was well washed out with hot saline solution and returned to the abdomen. The abdominal wound was closed with through and through silkworm-gut sutures without a drain.

Progress.—The bowels were opened on the second day by enema. The abdominal wound healed by first intention, and the

a *b*

FIG. 1.—Gall-stone removed in Case I from the ileum, about five feet above the ileocæcal valve, actual size. (*a*) Section showing the white centre and end and the dark laminated crust upon the body of the calculus; also, recrystallization in the middle. (*b*) Shows the rough and dark-colored exterior of the calculus.

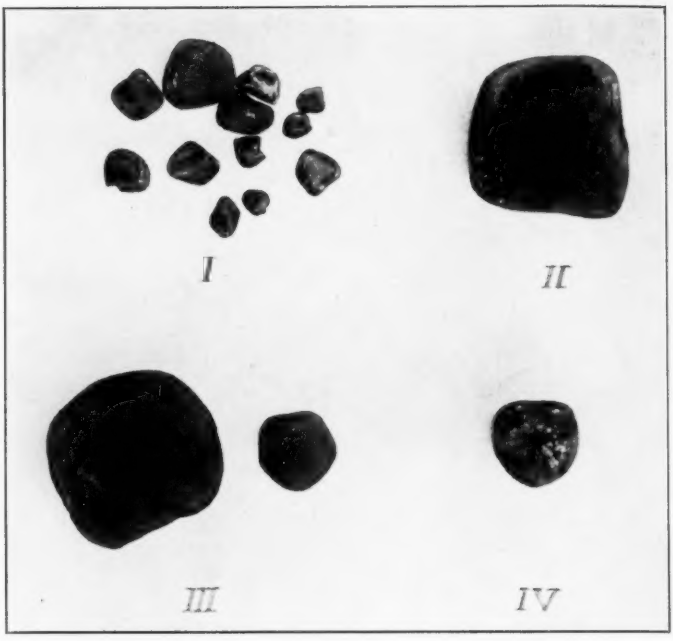

FIG. 5.—Actual size of calculi. Numbered according to loculi.

FIG. 6.—Case III. Calculus removed from jejunum. One and three-quarters inches by one and one-quarter inches; weight, 234 grains.

patient made an uninterrupted recovery, which was, however, a little delayed by cystitis and some retention of urine.

The *calculus*, the accompanying figure of which shows very nearly the actual size, was egg-shaped, and measured two and one-half inches in length, one and one-eighth inches in diameter, and three and one-half inches in circumference. It weighed 294 grains when dry. The structure was lamellated, but the central part, of nearly pure cholesterin, had recrystallized into a stellate arrangement. The narrow end presented a nipple-like projection of pure white cholesterin, which passed at a neck into the general body of the calculus, which was covered with a layer of dark-brown friable material. It will be seen in the diagram that the layers passed without interruption from the brown friable part to the pure white portion. It seems, therefore, probable that this nipple projected for a long time into the duodenum, and that the constant washing with acid chyme dissolved out the pigment from the exposed portion. Dr. Hunter, assistant bacteriologist to the London Hospital, kindly examined a scraping taken from the centre of the stone, and found it to contain bacillus coli communis. No typhoid bacilli were found; but in connection with the early age at which this woman developed a large gall-stone, it is interesting to note that the obscure hepatic signs of the stone followed an attack of typhoid some years before. Attention had been drawn to this point first by Bernheim in 1889, and afterwards by Dufort, Chiari, Mason, and Osler.

Case II.—In June, 1901, Mrs. M. M., aged sixty-three years, was admitted under the care of my colleague, Dr. F. J. Smith, for intestinal obstruction, and I was asked by him to see her with a view of operation.

History.—She gave a very clear history of previous biliary trouble. She had suffered for years from obscure pains in the right hypochondriac region, which she had always supposed originated from the liver, but she had never been jaundiced. While she was stopping at Hastings, in the summer of 1900, she had a very severe attack of pain in the region of the liver, accompanied by continuous retching, but not by actual vomiting. Her doctor told her the attack was due to the passage of the gall-stone. No search was apparently made for this in the motions.

The *present attack* was apparently produced by a purgative.

On Sunday night, June 10, 1901, the patient took a pill, and this acted very thoroughly on Monday. On Monday, June 11, 1901, at 11 P.M., and five days before she came to the hospital, she was seized with the most violent pains in her right hypochondrium, and with profuse and continuous bilious vomiting. She continued in this condition all night, but improved considerably in the morning (Tuesday, June 12, 1901). The sickness was much less. The colicky pains were, however, nearly as bad, but had now shifted to the umbilical region. An enema was administered, and produced a good result; her doctor was called in.

On Wednesday, June 13, 1901, the patient was still retching, and the vomited matter was now brown and offensive. Her medical man wished her to come up to the hospital, but she refused all surgical treatment.

Next day, Thursday, June 14, 1901, an enema produced a small result; she was much better; the vomiting almost ceased, and she obtained some sleep.

On Friday, June 15, 1901, she was much worse. The vomiting was now distinctly fæcal.

On Saturday morning, June 16, 1901, she consented to operation, and was brought up to the London hospital.

Condition on Admission.—Her general health was very bad. There was bronchitis, and her pulse was rapid and feeble. The abdominal examination was mostly negative in result. There was no distention and very little tenderness. No tumor could be felt either by palpating the abdomen or on examining the rectum and vagina, although Douglas's pouch was most carefully examined. The hernial rings were empty. A diagnosis of acute intestinal obstruction by gall-stone was made on the following grounds:

(1) The patient was a woman, and sixty-three years of age, suffering from acute intestinal obstruction.

(2) The definite history of previous hepatic pain and vomiting.

(3) The clear history that the pain in the present attack began in the hepatic region and shifted to the umbilical region later.

(4) The early profuse and bilious vomiting which remitted, and later returned and became fæcal.

(5) The late and incomplete constipation.

(6) The absence of distention, which pointed to an obstruction of the small intestine.

Operation.—Anæsthetic chloroform. During the whole operation she was regurgitating large quantities of fæcal vomitus. The usual laparotomy incision was made. As soon as the belly was opened, congested and dilated coils of small intestine presented, and some blood-stained fluid escaped from the peritoneal cavity. A hand swept round the pelvis proved the hernial rings were empty. The cæcum was then examined and found collapsed. The entering coil of collapsed ileum was brought out of the wound and followed up for about five feet, when a large calculus was found obstructing the lumen of the gut. The ileum above the stone was greatly dilated and congested; below it the gut was pale and contracted, so that the stone, as in the previous case, rested on a septum. The stone was removed, and the incision closed in an exactly similar way to that described in Case I. The contents of the intestine were heard gurgling past the obstruction before the belly was closed. A stomach-tube was passed, and several pints of feculent fluid were removed from the stomach, which was then washed out until the returning fluid was fairly clear. The patient's condition was, however, very bad after the operation. She was collapsed and had a continuous rattle in her throat.

Progress.—On the following morning she was cold, blue, and delirious, and her respiration was very rapid, 48 to 52 per minute. Her temperature had risen to 100° F. She had not been sick since the operation, and she had profuse diarrhœa with incontinence all night. She died in the afternoon, twenty-four hours after the operation.

The *stone*, of which a photograph is given here, was barrel-shaped and faceted at both ends. It was a dark coffee color and its outer layer was friable. The diameter was seven-eighths of an inch; circumference, three inches. The weight, when dry, was 103 grains. The faceting on either end appeared to indicate that this stone was one of three or more stones, of which one or more remained in the gall-bladder, whilst the passage of the other had caused the previous attack of pain and vomiting. The post-mortem examination, however, indicated that no large stone had previously passed, but that the upper facet was produced by several small stones found in the gall-bladder.

Post-Mortem.—The incision in the gut was soundly closed and surrounded by plastic peritonitis. There had been no leaking of intestinal contents. The predisposing causes of death were found in small, contracted, granular kidneys, the capsules of which would not strip, in a fat and flabby heart, and an atheromatous aorta. The endocardium and endarterium were deeply stained with blood pigments as in a septicæmia. The right lung was solid at its base and sank in water. The bronchial tubes

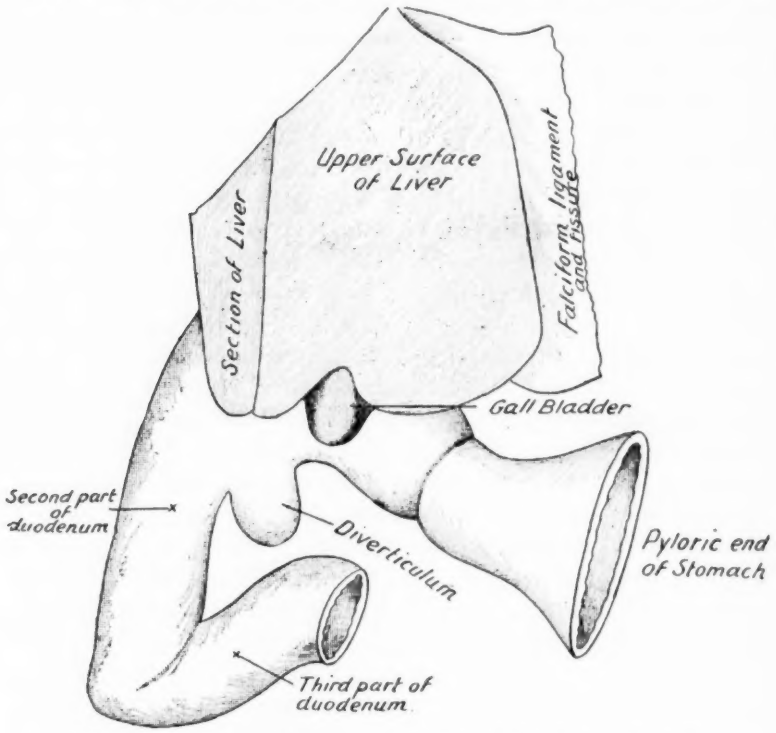

FIG. 2.—Diagram of the anterior view of the liver. Case II.

contained purulent matter. The left lung was in much the same but a somewhat earlier condition. The liver, gall-bladder, duodenum, pancreas, and stomach were removed *en masse* so as to be dissected and preserved.

The following structures were carefully dissected out:

(1) The duodenum. (2) The gall-bladder and the calculi it contained. (3) The hepatic, cystic, and common bile ducts,

and the pancreatic duct. (4) The portal vein, hepatic artery, and vena cava; these latter structures were normal, and need not be again mentioned.

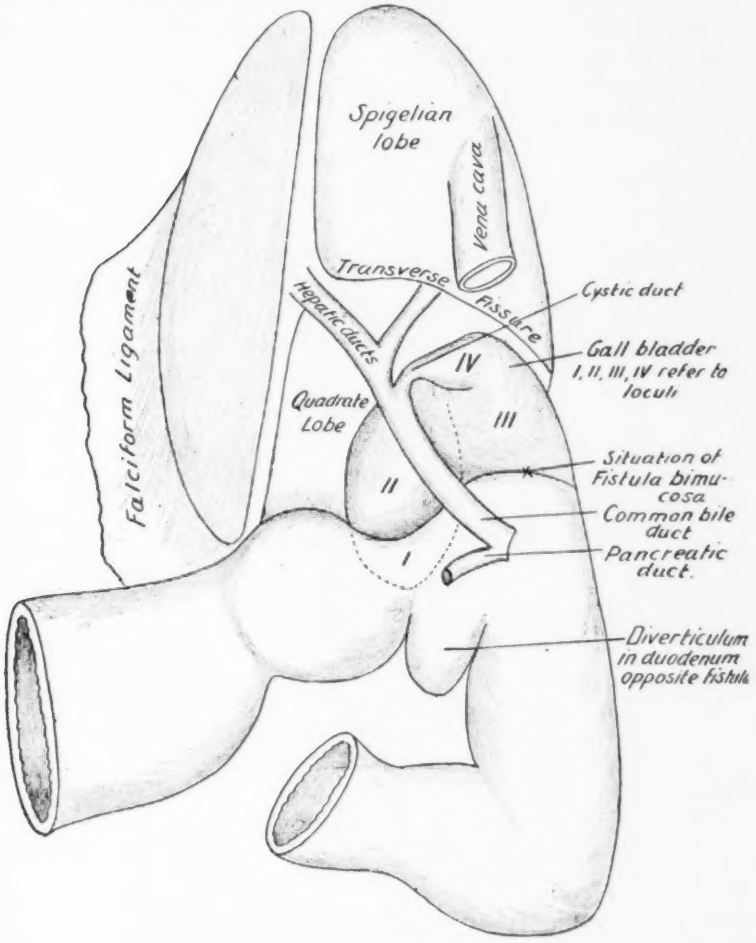

FIG. 3.—Diagram of posterior view of dissection. Case II. The portal vein and hepatic artery are not shown for the sake of clearness.

1. The *Duodenum* was hung up by adhesions to the neck of the gall-bladder. It passed from the pylorus one inch upward and to the right, and was adherent to the middle of the left border of the gall-bladder. It then passed in a loop or festoon behind

the gall-bladder, and was again adherent to the right side of the neck of that viscus. It was here that the fistula bimucosa existed. I was able to work the calculus, which had been taken from the ileum, back up the duodenum and through this fistula until it occupied its old quarters in the gall-bladder. A diverticulum was found springing from the lower border of the duodenum immediately opposite the fistula bimucosa. This diverticulum was buried in the head of the pancreas and was the size of a

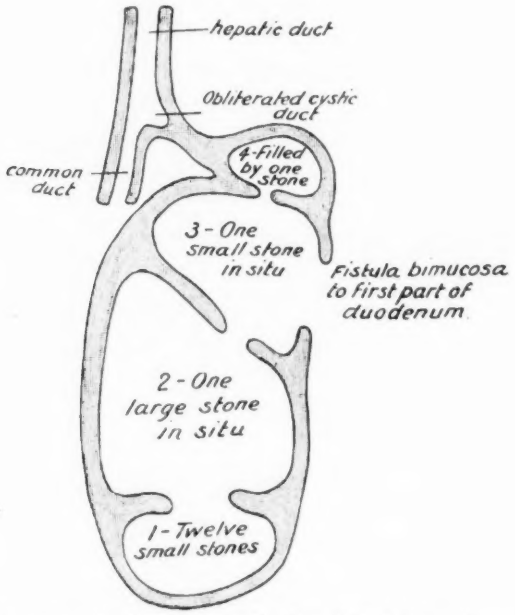

FIG. 4.—Diagrammatic view of loculi of gall-bladder and septa. It was thought at one time that the biliary colic might be due to the passage of another large stone. The facts showed that no such large stone had existed, and the ileocæcal valve was normal.

large hazel-nut. At first it was thought that the stone which had caused intestinal obstruction had lain for some time in this diverticulum after leaving the gall-bladder, but on actual trial the diverticulum was found to be far too small to hold the stone. It is possible that this diverticulum served as a by-pass to permit the flow of chyme past the obstruction caused by the gall-stone projecting through the wall of the duodenum immediately opposite to it. The entrance of the common bile ducts into the

duodenum was normal in position and structure. The third and fourth parts of the duodenum showed no pathological changes.

2. *The Gall-Bladder and Calculi.*—The gall-bladder was found divided into four loculi or compartments, separated from one another by dense fibrous septa, and communicating by orifices of not more than a quarter of an inch in diameter.

(1) The first at the fundus contained twelve small calculi, the smallest of which was the size of a tare, and the largest that of a pea.

(2) The second compartment, about the middle of the gall-bladder, contained a solitary large smooth calculus faceted at both ends, and only a little smaller than that taken from the ileum. It weighed ninety-seven grains when dry.

(3) The third loculus was near the neck of the gall-bladder, and it was this one which communicated with the duodenum. It was for the most part empty, so that the calculus taken from the intestine was reintroduced with ease, but in one corner a small calculus the size of a pea was found.

(4) The fourth and last compartment was at the very entrance to the cystic duct. It was not larger than a pea, and communicated by only a pin-hole with the third loculus. It was completely filled by a round tuberculated and pale-colored calculus. The cystic duct had apparently been obliterated by this stone, for no probe could be passed either from this compartment into the common duct or in the reverse direction. Perhaps this stone was impacted in the cystic duct, and had led by its complete obliteration to the necessity of a fistula into the duodenum.

3. *The Hepatic, Cystic, and Common Ducts.*—The hepatic and common bile ducts were very little, if at all, dilated. The common duct at its widest point would have just taken a medium-sized pencil. Its orifice into the duodenum was not dilated. The cystic duct, as has already been said, was obliterated, and existed only as a fibrous cord connecting the common bile duct with the neck of the gall-bladder. The common bile duct was clearly demonstrated to its entrance into the duodenum, and certainly the large stone removed from the ileum did not pass this way. The pancreatic duct was in no way abnormal.

CASE III.—I. P., a German woman, aged sixty-eight years, was admitted on the afternoon of September 11, 1901. She was in so collapsed a condition and spoke so little English that no

reliable history could be obtained. Apparently her illness began two months before, with severe abdominal pain and jaundice. Five days before admission she became acutely ill with profuse bilious vomiting and severe pain in the belly; but I could not discover where the pain had been. For two days she had passed no motion. The patient was an enormously fat woman. She was collapsed and nearly pulseless; when admitted, her pulse-rate was 103, but very feeble; her temperature was 95° F. An enema produced a small result. Her belly was soft and voluminous and not distended or tender; no tumor could be felt, and the hernial rings were all clear. The rectal examination was omitted. Under stimulants and a coffee and brandy enema she rallied a little in four hours, and it was then decided to operate, as a diagnosis of gall-stone intestinal obstruction had been made. The operation was carried out under eucaine local anæsthesia, and she experienced no pain except at the skin incision and when the mesentery was pulled upon. The usual laparotomy incision from umbilicus to pubes was employed, and three inches of fat were cut through before the muscular wall was reached. When the peritoneum was opened, most of the small gut was found collapsed and pale, but one coil in the upper part was congested and greatly distended. This coil was followed down, and almost immediately a large gall-stone in the gut was drawn into the wound, surrounded by sponges, cut on in the line of the gut and evacuated. The gall-stone rested on a septum formed by the junction of the distended and collapsed intestine, similar to that described in Cases I and II. In order to give her the best possible chance of recovery, it was determined to drain the gut at the point of suture, and accordingly a Paul's tube was tied in and fixed in the upper angle of the wound, and the remainder sutured with silkworm gut.

Progress.—Her condition was improved after the operation. She did not vomit, and her lungs remained clear. She evacuated fluid fæces freely from the tube, and, stimulated with strychnine and coffee and brandy enemas, she lived forty-eight hours.

Post-Mortem.—Only a partial autopsy was allowed. The liver and intestines were removed. The point of obstruction was found to be five feet from the duodenojejunal flexure and ten feet from the ileocæcal valve.

The *calculus* was large, rough, black, and barrel-shaped. It

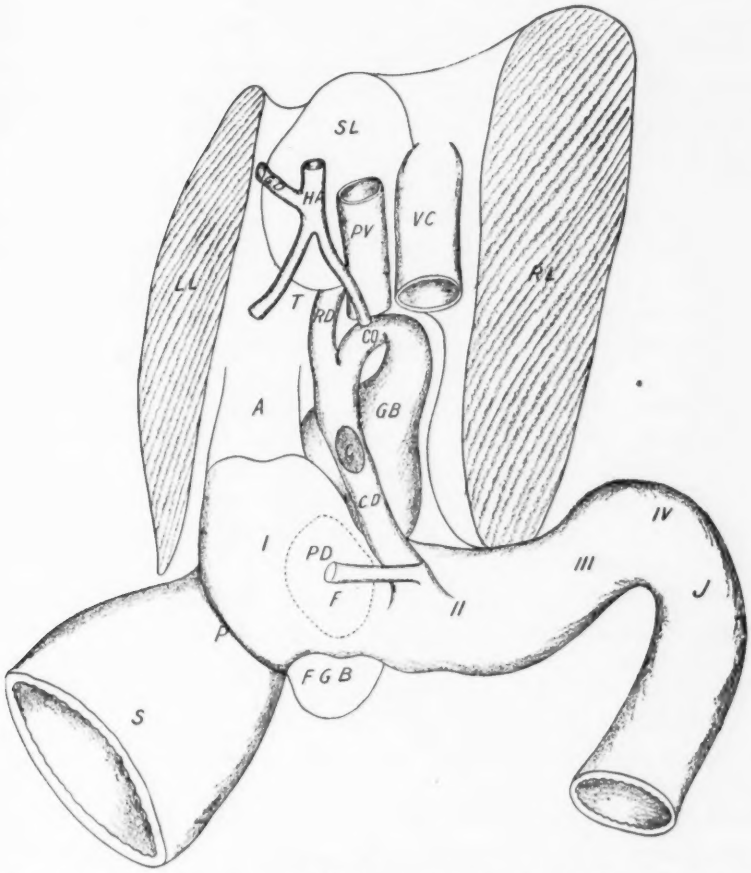

FIG. 7.—Liver, duodenum, gall-bladder, and bile ducts. Posterior view. Case III. *A*, adhesions binding first duodenum to liver; *S*, stomach; *P*, pylorus; *I, II, III, IV*, parts of duodenum; *J*, jejunum; *HD*, hepatic duct; *CD*, cystic duct, patent and dilated; *CD*, common duct, dilated to size of one-half diameter; *C*, calculus blocked in same, hence jaundice at commencement of attack, and perhaps dislodgement of calculus; *PD*, pancreatic duct; *T*, transverse fissure; *HA*, hepatic artery; *GD*, gastroduodenal artery turned up; *PV*, portal vein turned up; *VC*, vena cava; *GB*, gall-bladder adherent by anterior surface to, *I*, duodenum, where fistula occurred and stone passed, very thick and dense above; *F*, site of fistula; *FGB*, fistula bimucosa, right and posterior surface of gall-bladder; *SL*, spigelian lobe; *LL*, left lobe; *RL*, right lobe. The duodenum is not in the position in which it was found in this diagram.

measured one and three-quarters inches in length, one and one-quarter inches in diameter, and three and three-quarters inches in circumference, and weighed, when dry, 234 grains. At its lower end was a smooth, white area similar to that on the end of the calculus in Case I, which I presume had projected into the duode-

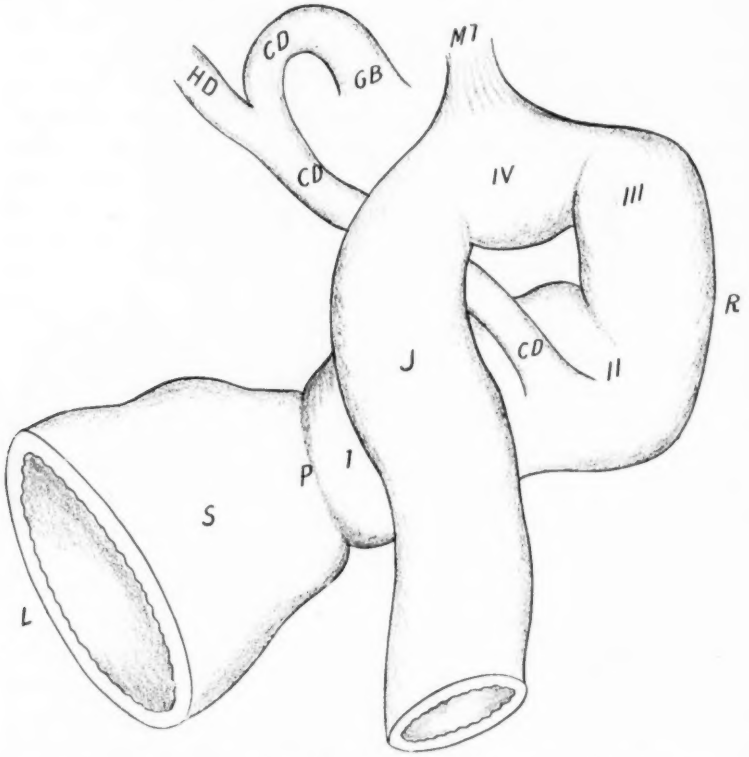

FIG. 8.—True position of duodenum. Posterior view. *S*, stomach; *P*, pylorus; *I, II, III, IV*, parts of duodenum. It is to be noted that the second and third parts both ascend to the junction with the jejunum held up by *MT*, the muscle of Treitz; *GB*, gall-bladder; *CD*, cystic duct; *HP*, hepatic duct; *CD*, common bile duct.

num for some time. On section it was found to be very friable, amorphous in structure, and not lamellated. The structure was coarse, and innumerable little crystals sparkled on its surface. I opened a gall-bladder recently soon after an attack of cholecystitis, and found it filled with gall-stone mud, in which were the

crumbling remains of a number of small faceted gall-stones. It appeared, indeed, that the acuteness of the inflammation had broken up a multitude of faceted gall-stones into this mud.

If the moisture were absorbed from this mass and it consolidated with the formation of minute crystals of cholesterin, it would produce just such a large friable amorphous calculus as in this case. I must admit, however, that I found no trace of partially eroded calculi on section; and of course this theory of the origin of large gall-stones would not apply to those which are lamellated.

The liver, gall-bladder, bile ducts, and duodenum were dissected as in Case II, and this specimen was shown with the other at the meeting of the Pathological Society.

The *Duodenum* was curiously twisted, and indeed inverted. The stomach, pylorus, and first part of the duodenum had apparently been forced downward, so that the second part ran up instead of down, and the duodenojejunal flexure and its suspensory ligament (muscle of Treitz) were on a much higher level than the pylorus and first part of the duodenum (Fig. 8). This was probably produced by tight lacing in youth, and the formation of the gall-stones may have been due to this cause, as has been urged by Mr. Arthur Kieth, who regards gall-stones as a part of what he has called corset disease. The first part of the duodenum formed practically the major part of the posterior wall of the gall-bladder, and here a large ragged fistula existed between them.

The *Gall-bladder* was not greatly enlarged, but its walls were thick, ulcerated, and adherent to the duodenum behind as described. It passed by a funnel-shaped neck into a dilated *cystic duct*, and this joined an equally dilated *hepatic duct*.

The *Common duct* when flattened out was one-half inch in diameter and somewhat thickened. About an inch below its origin a small elongated stone the size of a small bean was impacted. No doubt it was the passage of this stone which caused the onset of the symptoms two months before death with jaundice. When this jaundice subsided (for the patient was not more than tinged when admitted to the hospital), it was probably owing to the escape of bile by way of the gall-bladder around the calculus and through the fistula. It also seems probable that this stream of bile ultimately loosened the stone and led to its expul-

sion into the duodenum. The *pancreatic duct* was not dilated. The *pancreas* was firm and appeared somewhat fibrous, but it had been preserved in formalin.

In the last ten years there have been five other cases of acute intestinal obstruction due to gall-stones admitted to the London Hospital.

I wish to acknowledge my indebtedness to my House Surgeon, Mr. Hugh Lett, not only for his able assistance at the operation on Case I, and the care which he gave to the after treatment, but also for searching the records of the London Hospital for the following cases.

Case IV.—H. G., aged seventy-three years, was admitted on January 3, 1894, with a diagnosis of acute intestinal obstruction, under the care of Mr. Openshaw. She was a very fat married woman. Four days before admission, she was seized with sudden paroxysmal pain in the region of the umbilicus, and this had persisted. Vomiting had been constant for three days. It was fæcal at the time she was admitted, and had been so, her daughter stated, for some time previously. Constipation had been complete for five days. The abdomen was a little distended. No other sign was made out.

Operation.—Laparotomy was performed, and a gall-stone was found in the ileum one foot from the ileocæcal valve. The wall of the intestine was very thin and nearly ulcerated through. The gall-stone was removed by an incision on it, and the wound closed by Lembert's sutures. The patient did not rally from the operation, and died four hours later. No post-mortem was performed.

Case V.—G. S., aged forty-two years, was admitted to the hospital under the care of Mr. Eve, on March 19, 1894, suffering from intestinal obstruction. His previous history was of very great interest. In 1875, eighteen years before, he had a severe attack of pain in the epigastrium accompanied by tenderness and vomiting. During the next seven or eight years he was never entirely free from pain, *i.e.*, until 1884. He had severe attacks of pain about once every week during this period. He then consulted an eminent physician, who treated him for dyspepsia. Six months later the pain almost entirely disappeared, but was replaced by an obstinate constipation, making it necessary for him to take purgatives once or twice a week. Unless the bowels were open daily, the patient had a pain low down in his abdomen.

Mr. F. S. Eve is of opinion that during the whole of this period of ten years (1884-1894) the gall-stone was in the small intestine. On March 15, 1894, four days before admission, severe pain, with continuous vomiting and absolute constipation, suddenly appeared. Under an anæsthetic, a hard, bullet-like lump was felt in the right iliac fossa. Laparotomy was performed on March 20 by Mr. F. S. Eve, as no result had followed the use of enemata. A gall-stone was found impacted at the ileocæcal valve. This was displaced up the ileum in order that the incision might be through uninjured gut. The stone was then cut on and removed. The mucous membrane was first sutured, then the wound was invaginated by a continuous Lembert suture, and, finally, a piece of omentum was drawn over the incision and fixed by sutures. The gall-stone was one and one-half inches long, one inch in diameter, and three and one-quarter inches in circumference, and weighed 190 grains. It had no facet. It was of a dirty white color, and its surface, which is washed and worn, tuberculated and friable, is largely formed of phosphates. Indeed, it presents all over the appearance of the ends of the two calculi in my case which had projected into the intestine from the gall-bladder. This calculus is now in the Museum of the London Hospital.

Progress.—On the eleventh day after the operation, some thick, foul, yellowish-green pus discharged through the wound from a stitch abscess. The wound soon healed, however, and the patient left the hospital cured seven weeks after the operation.

This case was published in the *Clinical Society Transactions* for 1895, Vol. xxviii, page 91, with an analysis of twenty other cases.[1]

Case VI.—E. S., aged sixty-three years, was admitted to the hospital under the care of Mr. Jonathan Hutchinson, Jr., on November 6, 1895, with acute intestinal obstruction.

History.—She gave a clear history of attacks of jaundice and biliary colic. On November 2, 1895 (four days before admission), she had been seized with sudden and acute pain in the right hypochondriac region just below the ribs and with vomiting. The bowels were opened on the following day, but for the next three days the constipation was absolute and the vomiting continuous. On the day before admission the vomiting became fæcal. On admission the patient looked very ill, and she was

slightly jaundiced. Her pulse was rapid and small. The abdomen was tender and distended. Laparotomy was performed on the day of admission, and a gall-stone was found several feet above the ileocæcal valve. The gut above was greatly distended and congested, below it was contracted and empty. Enterotomy was performed and the stone evacuated through the wound; two small stones were found above it, and these fitted facets on the larger one. The stone which caused the obstruction was one and three-quarters inches long, one inch in diameter, and three and one-eighth inches in its greatest circumference. It weighed 191 grains. It was dark brown, and at its larger end presented four facets. The two smaller stones presented four facets each. It was clear that two or more other calculi were missing. The wound in the gut was closed in a similar manner to that described in the previous cases.

Progress.—The woman made an uninterrupted recovery, saving a sudden attack of collapse on the fourth day after the operation, for which no cause was found and from which she rallied. She was discharged quite well from the hospital a month later.

This case was recorded in the *Pathological Society Transactions,* 1896, Vol. xlvii, page 95.[2]

Case VII.—H. S., aged fifty-two years, was admitted to the London Hospital on October 24, 1898, under the care of Mr. McCarthy. He was in a state of profound collapse from acute intestinal obstruction. For ten days he had been vomiting, and latterly this had been fæcal. For four days he had suffered from absolute constipation. The patient was too collapsed for an operation to be performed. He died the day after admission.

Post-Mortem.—A large gall-stone was found impacted in the ileum, twenty-five inches from the cæcum. A fistula bimucosa was found connecting the gall-bladder and duodenum, which were united by peritoneal adhesions. Commencing peritonitis was present all over the small gut.

Case VIII.—S. N., aged fifty years, was admitted under the care of Mr. T. H. Openshaw, on November 27, 1899, suffering from acute intestinal obstruction.

Previous History.—She had never had an attack of jaundice. Twelve months before admission, she had a severe attack of abdominal pain, which came on suddenly and was spasmodic in

character. This was accompanied by vomiting. During the year she had six or seven similar attacks of spasmodic abdominal pain accompanied by vomiting, and each of about two days' duration. The present attack commenced ten days before admission with "spasms" and sickness. The constipation was absolute throughout, neither fæces nor flatus passed. On admission the vomiting was found to be fæcal. The abdomen was greatly distended.

Operation.—A gall-stone was removed from the ileum by an incision directly over the stone. The wound was closed by a double layer of sutures, the outer being Lembert's. The patient died forty-eight hours later.

Post-Mortem.—The wound in the gut was found to be soundly united and water-tight. A fistula bimucosa connected the gall-bladder with the first part of the duodenum, these parts being firmly united by peritoneal adhesions.

Remarks.

The frequency of intestinal obstruction due to gall-stones varies very greatly in different accounts. Osler,[3] quoting Fitz, makes it as common as one to thirteen cases of intestinal obstruction (twenty-three cases of gall-stones in 295 obstructions), Leichtenstern gives forty-one cases out of 1152 obstructions, or about one to twenty-eight.

The London Hospital records for the eight years in which the above eight cases of gall-stone obstruction occurred show that there were 360 cases of intestinal obstruction, including chronic obstruction. This proportion is one to forty-five cases of obstruction. The last figures are probably nearer the truth, as it appears that the tables of Fitz and Leichtenstern[4] were from reports of cases, and were not consecutive. Gall-stone obstruction occurs in women five times more frequently than in men. In the above eight cases only six were women and two were men.

The average age of twenty cases collected by Mr. F. C. Eve[5] was sixty-four, and according to Sir F. Treves it is fifty-seven. Case I is therefore remarkable in that the woman was but thirty-seven, and Case III in that it was a man and only forty-two. These large gall-stones, for the most part, pass into

the first part of the duodenum at a point where it lies against the neck of the gall-bladder by a process of ulceration after these parts have become united by adhesions. This fistula bimucosa was found in Cases II, III, V, and VI, the only post-mortems in the above series.

Less often the calculus ulcerates into the jejunum or transverse colon. Dr. Horace Jeaffreson, in the *British Medical Journal*, May 30, 1868,[6] narrates a case in his brother's practice in Suffolk where a large gall-stone was vomited, and at the autopsy some time later the gall-bladder was found adherent to the stomach. In several cases gall-stones have been discharged into the urinary bladder, and there is even an octavo work written by H. Faber, 1839,[6] on this curious complication. Abt, Gutterboch, and Hahn[6] have recorded examples of bilary calculi occurring in the urinary bladder, and Köstlin and Wucherer,[6] cases in which the communication was direct between the two bladders. Sir F. Treves says in the chapter devoted to gall-stones, in his book on "Intestinal Obstruction"[7] that no stone can cause obstruction in the intestines which has passed safely along the biliary passages. Osler, on the other hand, quoting Courvoisier (*Ibid.*), states that at the post-mortem examination of several of these cases the common bile duct was found dilated, so that it easily admitted the finger, and presumably no fistula existed, although he does not say so. The site of the obstruction is usually the lower part of the ileum and the ileocaecal valve. The small intestine becomes narrower from its upper to its lower end; and since small stones are more common than large ones, if they cause obstruction at all, it will be near the neck of this elongated funnel. Thus, if we arrange the cases given in Sir F. Treves's article and those in the above series according to their diameter and point of obstruction, we obtain the following table:

Diameter of Calculus.	Point of Obstruction.
2 1-4 inches.	Upper jejunum.
1 1-3 inches.	Jejunum.
1 1-4 inches, Case III.	Middle jejunum.
1 1-7 inches.	Lower jejunum.
1 1-8 inches, Case I.	Five feet up ileum.
1 inch, Case VI.	Several feet up ileum.
1 inch.	Ileum.
7-8 inch, Case II.	Five feet up ileum.
1 inch, Case V.	Ileocæcal valve.

In other words, the higher up a gall-stone causes obstruction the larger we may expect it to be. As a rule, any gall-stone less than one inch in diameter passes spontaneously.

The ileocæcal valve is one of the narrowest spots in the alimentary canal, and might be expected to obstruct for a time the passage of a calculus which it eventually permitted to pass. Thus, MacLagan[8] has recorded a case (*Clinical Society Transactions,* Vol. xxi, 1888, p. 87) in which a woman, after four severe attacks of intestinal obstruction, passed spontaneously four large gall-stones each one inch in diameter, and at the post-mortem only the fringes of the ileocæcal valve remained. Many causes appear to combine to produce the obstruction. The small intestine is adapted to propel fluid contents, and its interior is lined with valvulæ conniventes to delay the flow of chyme along it. It has not a smooth interior and a powerful muscular wall like the rectum and sigmoid adapted to propel scybalous masses comparable to large gall-stones. The rough surface of the gall-stone is moreover ill adapted to glide along the intestine, and should it remain there for any length of time, as it appears to have done in Case III, its bulk is further increased by rough intestinal accretions.

Spasm of the intestine at and below the stone excited by its rough surface, according to Duplay and Reclus,[9] is responsible for the main part of the obstruction. They state that at many autopsies on these cases the stone has been found lying quite loosely in the relaxed intestine. In Cases I, II, III, and VI the operator found the gut so contracted below and dilated above that the stone rested upon a septal-like pro-

jection in the gut, and could by no reasonable pressure be passed on along the gut. This spasm of the intestine would also account for the success which in former days attended the exhibition of morphia and belladonna in some cases, since these are drugs capable of relaxing this spasm.

Another point of interest about these cases is that there is no true strangulation of intestine. They are pure cases of obstruction to the contents of the small intestine without interference with its blood supply. It follows from these considerations that the gut is not paralyzed throughout, as it is in most other cases of acute intestinal obstruction, and a recognition of this fact will make the anomalous symptoms of gall-stone obstruction easy to understand. These symptoms may be summarized thus:

The onset is sudden. The pain and collapse are seldom severe until late in the attack. The constipation is illy marked, and in many cases the patients have passed flatus and even small motions after the onset of the acute symptoms.

In Cases I, II, and IV purgatives and enemas produced a motion even when the calculus was in the intestine. The abdomen is neither tender nor markedly distended as a rule. The prominent symptom is vomiting, which is severe, continuous, profuse, and early deeply stained with bile, so as to closely simulate fæcal vomiting.

In a case of Dr. Pye Smith's quoted by Treves,[10] where the stone was impacted in the upper jejunum, the patient vomited one and one-fourth gallons of bilious fluid in forty-eight hours, and died on the sixth day.

The vomiting, moreover, in Cases I and II could be divided into three stages. In the first it was sudden in onset and severe and profuse in character. In the second stage, when the stone had moved from a close proximity to the stomach, it remitted. In the last stage, when the stone became impacted lower down, it returned, and was like the fæcal stage of ordinary acute intestinal obstruction.

The calculus was probably felt in Douglas's pouch in Case I, and was certainly felt in the region of the ileocæcal

valve in Case V. This is a rare occurrence, for Treves[11] states that he could find no case in which the calculus was felt before operation. In the diagnosis of this condition it is usual to make a great point of previous biliary symptoms, but when we remember that the large stones capable of causing intestinal obstruction are usually single, and that they do not, as a rule, pass down the duct, we perceive at once that jaundice and true biliary colic will generally be absent, and that the symptoms will be limited to more or less obscure pain in the region of the liver. In Case VI, however, the obstruction was due to the largest of the three stones; moreover the presence of several facets indicated further calculi, and there was accordingly a clear history of attacks of biliary colic and jaundice. In my second case there was definite hepatic pain, but not jaundice or colic. In my third case the attack of jaundice which heralded the obstruction was caused by the gall-stone found in the common duct.

The mortality after operation for gall-stone obstruction is apparently very high. Waring[12] quotes the following figures: Lobstein, thirty-one cases of operation; mortality, 61.3 per cent. Courvoisier, 125 cases of operation; mortality, 44 per cent. Schuller, eighty-two cases of operation; mortality, 56 per cent. Jonathan Hutchinson, Sen., mortality, 50 per cent.

Mr. Eve[13] collected twenty cases of gall-stone obstruction when he reported his own case. Of these fifteen were submitted to operation, and six died, that is to say, 40 per cent. Of the series of eight cases reported above, seven were operated on, and of these four died, making a mortality of 57.12 per cent. Of the four that died, one aged sixty-three had been obstructed five days; one aged seventy-three had been obstructed five days; another aged fifty had been obstructed ten days, and the last, aged sixty-eight, five days.

Tillmann states that recent results are much more favorable, and he quotes Korte as having saved four out of five consecutive cases.

Treatment.—So seldom has it been possible to state before

operation that intestinal obstruction was due to a gall-stone, that it is useless to discuss a treatment which presupposes such knowledge. The problem, as in all other cases of acute intestinal obstruction, is to ascertain the existence of organic obstruction *at the earliest possible moment.* We may then open the abdomen, ascertain the exact cause, and proceed accordingly. The most certain test of the presence of organic obstruction appears to be the turpentine enema (one-half to two ounces of turpentine in sixteen ounces of soap and water); if this is returned on two consecutive occasions without flatus or fæces, the obstruction is almost certainly organic, but even this sign, as has been pointed out, is of uncertain value in gall-stone intestinal obstruction.

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[6] For these references I am indebted to Mr. Jonathan Hutchinson, Jr., F.R.C.S., Jeaffreson, H. Faber, Abt, Guterboch, Hahn, Köstlin, Wucherer.

[7] F. Treves: Intestinal Obstruction.

[8] MacLagan: Clinical Society Transactions, 1888, Vol. xxi, p. 87.

[9] Duplay and Reclus.

[10] F. Treves: Intestinal Obstruction.

[11] Ibid.

[12] Waring: Diseases of the Liver and Gall-bladder.

[13] F. C. Eve: Clinical Society Transactions.

ANGIOTRIPSY AS A SUSTITUTE FOR THE LIGATURE IN ROUTINE WORK OF GENERAL SURGERY.[1]

By OSCAR J. MAYER, M.D.,

OF SAN FRANCISCO, CAL.

As recently as 1896, a new method was given to the profession by Doyen, in the presentation of the angiotribe, or "pince à pressure progressive," as he called the instrument, which he employed in the compression of the broad ligaments or the pedicles of tumors. This was to replace the method of compression by clamps, which had to remain *in situ* for twenty-four to forty-eight hours, the angiotribe accomplishing the same results in two to five minutes. Tuffier, Thumin, and others have improved the original instrument. I have also heard that Bissel, of New York, arrived at the same idea almost simultaneously with Doyen, but have not been able either to see or secure the instrument he devised.

However many advocates the angiotribe has to-day among gynæcologists,—although, because of its cumbrousness, they are few in number,—it is rarely, if ever, employed in general surgery. This is doubtless due to the same objection, and also to the ready application of the ligature in general surgery. While the gynæcologist has felt the necessity of something to simplify and render easier the "technique" of hysterectomies, and also to do away with secondary hæmorrhages from the slipping of ligatures, in infiltrated tissues, or tissues containing many vessels of small size, like the broad ligaments and the pedicles of tumors, the surgeon has become so confident in his ligature

[1] Read before the California State Medical Society at its annual meeting, San Francisco, April 15-17, 1902.

that he has not felt the need of anything to replace it. He has not made use of angiotripsy, since in the angiotribe he has but an awkward substitute for the ligature. Its weight on an isolated vessel, even if supported, rather increases the liability to tear the thinned-out tissues.

The use of the angiotribe, however, has forced recognition of these facts: that forcible compression of the blood-vessels or sealing them by compression (which would appear to be a more correct term than "crushing") goes far towards rendering the work of the surgeon more expeditious; that it obviates the dangers of infection by ligature, either imperfectly sterilized or secondarily infected by repeated handling or from secondary wound infection.

If, therefore, the advantages of the angiotribe can be retained by any process, and its disadvantages removed or minimized, has not a distinct advance been made?

Pursuing investigations in this direction, for the last two years I employed the ordinary hæmostatic forceps, with supplemental pressure supplied by a forceps improvised from a dental forceps. I used this on vessels of small size, with varying success, not entirely satisfactory, until the present stage of improvement in my experiments and operations had been attained. The simplicity of the procedure, in its present form, should prompt its adoption by the surgeon.

The perfected instruments which I have used in my experiments, and also in my recent operations (and for which I am greatly indebted to the ingenuity of R. Hoppe, instrument maker), consist of a hæmostatic forceps and a pressure forceps of 1000 pounds to give supplemental pressure to the former. The hæmostatic forceps I employ (Fig. 1) has a larger and broader snout than ordinarily, not tapering, permitting it to compress the tissues squarely and to equalize the pressure. The inner surface of one blade shows fine, shallow serrations in the steel, while the other blade shows a lining of alloy, with serrations moulded by pressure, the one surface fitting exactly into the other. This has been found to answer the purpose

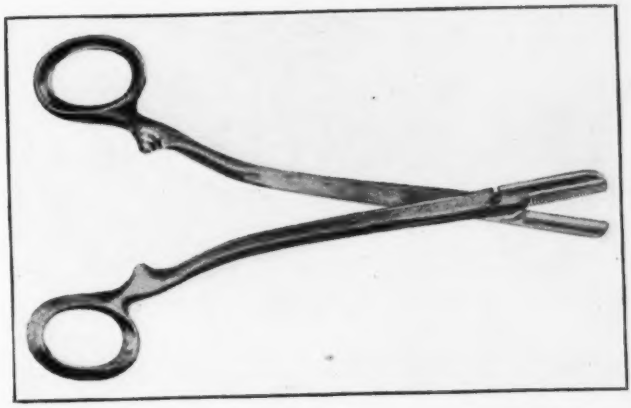

Fig. 1.—Hæmostatic forceps (one-half actual size).

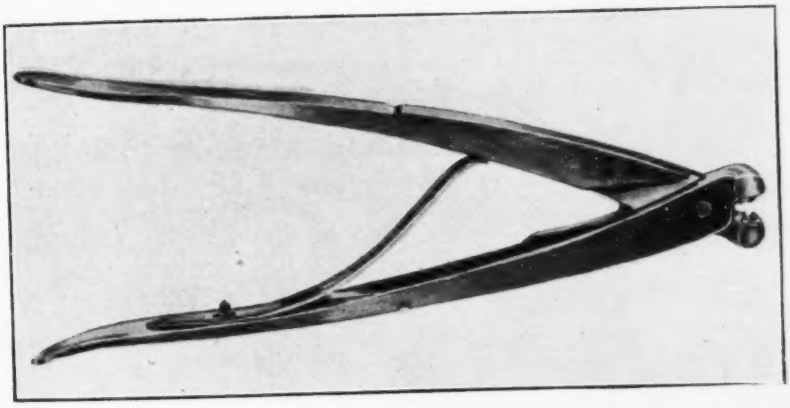

Fig. 2.—Pressure forceps (one-third actual size).

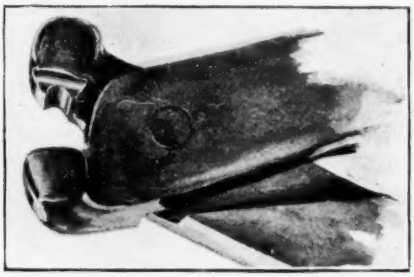

FIG. 2a.—Showing serrations of pressure forceps (actual size).

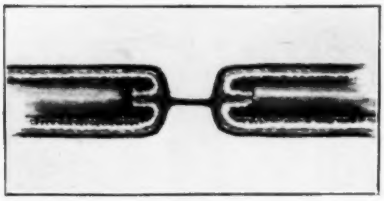

FIG. 3.—Section of artery, showing immediate result of angiotripsy.

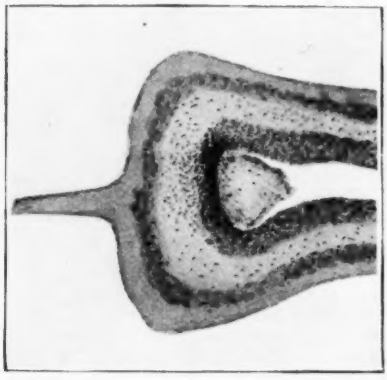

FIG. 4.—Posterior tibial artery of dog, killed eleven days after angiotripsy.

better than steel upon steel. The latter has a tendency to cut through, because the slightest variation of surface has been found to lacerate the tissues. The pressure forceps (Fig. 2) I employ must of necessity be large and heavy to exert such high pressure by direct force. It is a powerful forceps, thirty-two centimetres long, the lock only one and one-half centimetres from the blades, which are grooved in both transverse and longitudinal direction for receiving and steadying the hæmostatic forceps (Fig. 2*a*). Of simple construction, it answers fully all requirements of strict asepsis. It has no more title to elegance than the angiotribe in its most recent modification, but a shorter handle or lighter construction would require much more manual force, and make the hand of the operator unsteady, thereby making likely or actually causing laceration of the vessel.

I am not alone in my efforts to simplify the angiotribe for use in routine surgery. A. Schulte has recommended a hæmostatic forceps with a short snout and a leverage on the handles five times the distance of the snout from the lock. Zweifel makes use of the toggle-joint. The latter does not answer the requirements of asepsis, and the water corroding the locks often renders the instrument unfit for use, and the screws break at a critical moment. Both the above methods are only applicable to small subcutaneous vessels, such as are divided in cœliotomy or hernia operations, where most surgeons have found the ordinary hæmostatic forceps left *in situ* during the time of operation sufficient to accomplish perfect hæmostasis. The *modus operandi* in the latter case is different from angiotripsy, and hæmostasis is obtained by a clot forming without cutting the inner coats, simply holding them together by agglutination. In vessels of such small size, this answers the purpose, especially where secondary hæmorrhage is prevented, after the divided structures are united by sutures, which exert the pressure necessary to prevent reopening.

In applying this great pressure to arteries, it will be seen that the inner and middle coat are cut through and recoil, while

the outer serous coat is firmly compressed (Fig. 3). The watery elements being displaced, the two surfaces become firmly agglutinated.

In veins, the inner coats, being so much thinner, do not recoil, but are agglutinated in the same manner as in the arteries. On larger vessels, the hæmostatic forceps should be left *in situ* for a few minutes after pressure has been applied. The length of time the pressure should be applied, and also the time the hæmostatic forceps should remain *in situ*, will quickly suggest itself to the surgeon who uses angiotripsy as a routine practice. Care must be taken, however, in the use of the hæmostatic forceps that it be applied at right angles to the axes of the vessels, so that it will not cut the inner coats obliquely. The instrument must also be held very steadily, as any twisting or pulling is apt to cause lacerations and consequent hæmorrhage. In amputations or operations where Esmarch's constriction has been employed, the hæmostatic forceps must be allowed to remain *in situ* until the circulation has been re-established.

The fact that after compression the forceps can remain attached as long as necessary, and not endanger hæmorrhage from tearing by its own weight, should greatly enhance its value to members of the profession who have learned by experience the advantages of the angiotribe in pelvic and abdominal surgery.

In animal experiments I have made on the dog and sheep, I have had perfect results from compressing in this manner the radial, the brachial, the posterior tibial, the femoral, and branches of the mesenteric arteries. These arteries were selected on account of their easy access. In all cases except the mesenteric, though the incision was closed by sutures, the wound healed by granulation,—the animals licking the wounds and preventing healing by first intention. No secondary hæmorrhages were encountered in any of the above experiments, though no bandages or immobilization were employed, and the animal was allowed to roam at large after the third day. The resulting scar tissue, firmly surrounding and embedding the

divided end of the arteries, made it rather difficult, after the animal had been killed, to dissect out the end of the vessel with the nicety desired to show the ribbon-like thinness and complete occlusion of the vessels.

The specimens show that the tissues thus treated are not devitalized and do not become necrosed, but are only powerfully compressed, the life of the cells not being destroyed.

Just as the angiotribe has been used in septic cases, this method may be employed where we deal with similar conditions in general surgery. A ligature in such cases, becoming infected, prolongs the process until it is cast off, only after a continued process of suppuration.

The microscopical examination of fresh specimens confirms the report of Thumin, who wrote, regarding the angiotribe, that the tissues are forcibly compressed without being destroyed. It will be seen that the cells are crowded and compressed, chiefly because of the squeezing out of the watery element and fat contained therein.

In the specimens obtained from dogs, after waiting until the time in which secondary hæmorrhages could occur had elapsed, it was found that the process of healing is the same as in vessels tied with a ligature. The inner coats are perfectly united; a strong cell infiltration is seen where the two ends oppose each other. The outer coat in the ribbon-like continuation shows ordinary cell distribution. In the lumen of the vessel was observed the remnant of the organized blood-clot, not yet entirely absorbed (Fig. 4).

Without referring to the cases where I used the ordinary hæmostatic forceps with supplemental pressure, I have used the more perfected instruments in routine practice, including four cases of amputation of the mammæ, with clearing out of the axillæ, one Pirogoff amputation, two amputations of the lower part of the leg, one thyroidectomy, operations for removal of diseased cervical glands, and several partial amputations of the fingers. In none of these cases did I meet with secondary hæmorrhage at any time after the operation.

One very important factor has impressed itself upon my mind, that sponging the parts in which vessels have been compressed by this method *must be done by direct pressure, and not by lateral friction over the surface,* inasmuch as such friction pulls on the vessels, and has a tendency to reopen the compressed end of the vessels and precipitate hæmorrhage.

In the Pirogoff operation referred to above, I had to deal with a man aged fifty-eight years, who suffered from general arteriosclerosis. Feeling some anxiety in regard to a secondary hæmorrhage, I introduced the sutures of the flap deep enough to bring additional pressure against the end of the artery, so that, even if the clot should be loosened and force open the agglutination of the end of the vessel, it could not be readily expelled. Recovery took place without the anticipated accident.

Since following this mode of procedure, especially in operations involving such a large area as amputation of the mammæ, I have been particularly impressed, when removing the first dressing, with the comparatively small amount of wound secretion. A noteworthy feature in this operation was that I removed the drainage tube in the axillæ on the third day, and closed the aperture by secondary sutures introduced at the time of operating. Formerly, I did not change the dressing, unless indicated by the temperature curve, before the eighth day, when the drainage was removed and the wound allowed to heal by granulation. In all four cases, passive motions were made as early as the fifteenth day, the closed wound being protected by a light bandage, and the arm carried in a sling.

This can no doubt be explained not only by the absolutely perfect hæmostasis which can be accomplished, arresting even the slightest oozing, but also by the absence of ligatures. The ligature when first introduced into the wound no doubt exercises an irritant action as a foreign body causing increase of the wound secretion, until the process of absorption, fully established, helps to dry the wound. This should be a great factor in inducing surgeons to use angiotripsy more exten-

sively, as it will in many instances render drainage obsolete, or, where this is impossible, considerably curtail the time necessary for its employment, as well as greatly lessening the chances of infection, by restricting secretion.

Another great advantage is observed, and that is that suffering is reduced to a minimum. The nerve filaments, often unavoidably enclosed in the ligature of an artery, cause a great deal of pain to the patient; this is especially observed in ligating the digital arteries. There is comparatively little pain when angiotripsy has been employed, as it crushes the nerve.

That pain is thus reduced to a minimum by reason of the complete crushing of the nerves has particularly impressed itself upon me in operations for hæmorrhoids where I have employed angiotripsy instead of the clamp.

In extirpations of extensive cervical tubercular as well as carcinomatous glands I have not used a single ligature; and others to whom I have shown this method have achieved the same results.

In thyroidectomy, angiotripsy has rendered me excellent service, the isolated vessels being compressed in the usual manner, while the angiotribe was employed crushing through part of one lobe to be retained, and the isthmus.

While I have successfully used this method on animals, on as large a vessel as the femoral, I do not underestimate the danger, nor the responsibility of the surgeon, in using it on as proportionately large a vessel in man. A precautionary or supplementary ligature applied, after angiotripsy, to one or two such large vessels involved in so large an operation as high amputation would not lessen the advantages derived from the employment of angiotripsy, and the ligature necessary in such cases could be of such fineness that complete sterilization would leave no doubt as to perfect asepsis. It is also self-evident that in a friable organ, such as the liver or kidney, or in a sinus, like in the dura mater, angiotripsy is of no avail.

From the observations of men who have used the angiotribe more or less since its origin, and also from my own obser-

vation with the more improved instruments and their simplicity of application to general surgery, I am convinced that angiotripsy has a decided advantage, a large field of application, and has greatly enriched surgical technique.

I am especially indebted to Drs. E. S. Howard and J. R. Clark for their assistance rendered in my operations and in making the animal experiments, and also to Dr. J. M. Stowell for preparing the microscopical specimens.

MORRISON'S OPERATION FOR ASCITES DUE TO LAENNEC'S CIRRHOSIS.[1]

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The patient we have to present gives the following history:

J. C., male, forty-six years old, a laborer, was at three different times a patient in the Presbyterian Hospital.

At the time of his first admission, July, 1898, he complained of indigestion, occasional vomiting, some dyspnœa, and a gradually increasing enlargement of the abdomen, besides swelling of the ankles and feet. The patient's history showed no syphilitic, tuberculous, or rheumatic disease. He had been an habitual user of alcohol for many years, chiefly in the form of whiskey.

Abdominal paracentesis relieved the symptoms, and his general condition improving, he left the hospital in the following September. He was able to work for several weeks. There was a gradual recurrence of his former symptoms, and he again entered the hospital, March 27, 1899. Repeated attacks of diarrhœa had troubled him all winter. Physical examination at this time showed an abdomen moderately distended; tympanitic in the epigastric, hypochondriac, and umbilical regions, dull in lumbar and hypogastric. Fluid wave appreciable. Edge of liver not palpable. Splenic edge not palpable because of abdominal distention, but the area of percussion dulness was increased. Stomach tympany reached as high as the upper border of the fourth rib. The superficial veins of the abdomen are more distended than usual. There was a slight cyanosis of the lower extremities. Circumference of abdomen at the umbilicus was thirty-seven inches.

[1] Read before the New York Surgical Society, April 9, 1902.

Thorax.—Heart apex not appreciable by inspection or palpation, apparently in the fourth space just within the nipple-line. Second sound slightly accentuated. There is moderate icteroid tinge of the face and conjunctiva.

Lungs.—Negative over the right; left gives dulness posteriorly over the lower fourth, and with slight feebleness of respiration murmur. Pulse is of low tension, without thickening of the vessel walls. He was treated for eleven days with diuretics and became salivated. As during this time his circumference had decreased but a little over half an inch, paracentesis was resorted to on April 10, and he was discharged improved on April 28, 1899.

He worked during one week, when his symptoms rapidly reappeared, and he was readmitted to the hospital on May 31, 1899. His abdomen is more distended than at any previous time, besides having œdema of the scrotum and lower extremities. The urine contained albumen and casts. There was some endocardial trouble. Circumference at the umbilicus, thirty-nine inches.

Abdominal paracentesis was performed on June 1, 1899, 356 ounces; June 14, 333 ounces; June 23, 323 ounces; July 5, 392 ounces; July 18, 337 ounces; July 27, 347 ounces; August 10, 397 ounces; August 20, 381 ounces. Total quantity in seven weeks was 2866 ounces.

The man was rapidly losing. He was so well aware of his hopeless state that the proposal of the attending physician, Dr. Tuttle, to be transferred to the Surgical Division for operation was accepted.

On September 1 measurement of the abdomen showed forty-one inches. (Fig. 1.)

Operation, September 2, 1899.—Chloroform; asepsis. A five-inch incision was made between the ensiform and umbilicus, and a two-inch incision above the symphysis. On evacuation of ascitic fluid, the omentum was seen to be small, shrivelled, and lumpy. The veins were large and tense. The lower margin of the omentum reached to the umbilicus, where it was adherent to the parietal peritoneum. The round ligament was the size of a finger and hard. The liver was hard and small. On its surface were the characteristic hobnail lesions. The spleen was thought to be more than twice its normal size. The convexities of the liver and spleen as well as the peritoneal surfaces opposed to

FIG. 1.—J. C. September 1, 1899. The day before operation. Circumference of abdomen, forty-one inches.

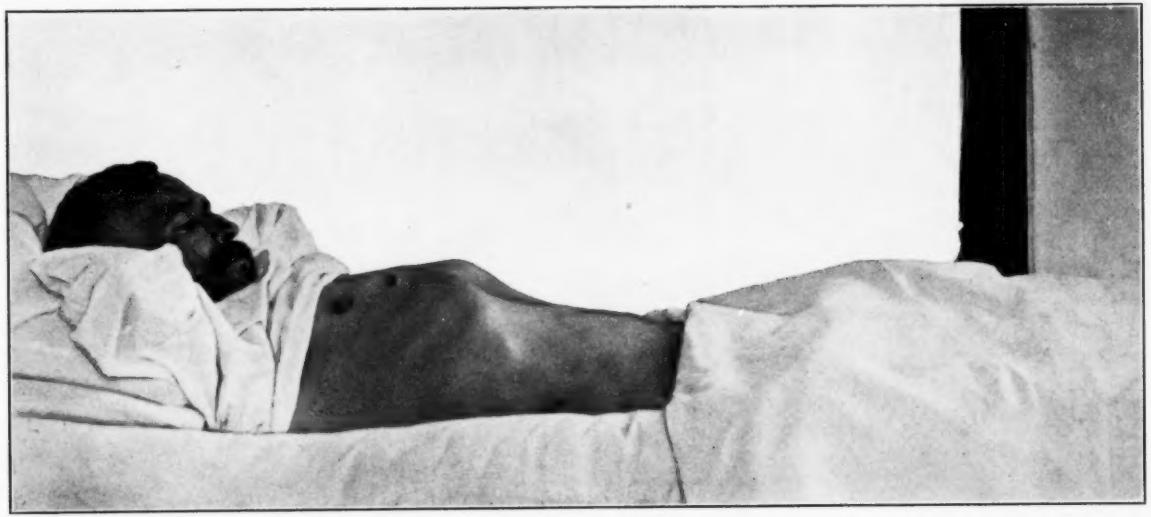

FIG. 2.—J. C. October 10, 1901. Two years after operation.

them were vigorously rubbed with dry gauze sponges grasped in long metal holders. The parietal peritoneum fronting the omentum was treated in the same way before suturing these tunics with chromicized catgut. There was but one transverse line of eight or ten sutures. The layers of this upper abdominal wound were individually closed in the usual way.

Through the lower wound an inch and a quarter diameter glass tube was passed into the pelvis behind the bladder. Capillary drainage was provided for by sterile gauze led through the tube. Adhesive straps half encircling the trunk were drawn over the upper dressing from the ensiform to the umbilicus. Vomiting was troublesome for the forty-eight hours after operation. Champagne was serviceable.

The large gauze and cotton dressings had frequently to be changed; the bed was sometimes wet from the serous overflow. At each change a syringe passed into the glass tube would generally remove six to eight ounces of serum. During the second week the quantity of ascitic fluid was much less. The upper wound healed *per primam.* Compression of the lower part of thorax and upper part of abdomen was continued for three months. On the twenty-third day the large glass tube was changed for a smaller one. The patient at this date was sitting up in bed eating and digesting solid food for the first time in seven months. The abdomen at the umbilicus measured thirty-five inches.

October 10, the thirty-eighth day, drainage tube removed. Patient out of bed. October 18, abdomen measured thirty-two and a half inches. November 1, both wounds closed; measurement, thirty-two inches. Appetite good; bowels regular. Urine gives no evidence of albumen or casts.

At our request, Dr. Tuttle on January 5, 1900, kindly made a physical examination of the patient and reported as follows:

"Patient well nourished. Color good. No jaundice. Chest somewhat barrel-shaped. Lower border of ribs somewhat everted and prominent, superficial veins prominent, especially on right side.

"*Heart.*—Apex beat neither visible nor palpable. Located by auscultation in fifth intercostal space, three and three-quarters inches to left of median line. Action regular and of moderate force. No murmurs.

"*Lungs.*—Percussion note in front a little wooden in quality. Slight dulness over both bases behind. Breathing over both apices in front a little roughened, rather feeble over both bases behind. Voice normal. No râles.

"*Abdomen.*—Not prominent. A moderate amount of superficial fat. Two linear scars in median line, one above and one below the umbilicus. Superficial veins not prominent. Percussion note moderately tympanitic all over and decidedly tympanitic over epigastrium. A little dulness in both flanks, but no signs of fluid.

"Palpation shows an area of slightly greater resistance, and an indefinite rather than soft mass in hypogastric region beneath and around the lower scar, apparently due to adhesions. There is nowhere any tenderness to pressure.

"*Liver.*—Dulness extends from fifth rib to near the costal margin. The edge cannot be felt.

"*Spleen.*—The area of dulness is increased. The edge is not felt.

"Extremities normal, with exception of some brown pigmentation over shins.

"The changes noted in comparing with examination in April, 1899, are: Heart apex has descended from fourth to fifth intercostal space. Liver dulness begins at fifth instead of fourth rib. The circumference of abdomen has diminished from thirty-seven inches to thirty-two inches, while the fat of the abdominal wall has decidedly increased."

On leaving the hospital three months later, the patient was able to take up heavy work again, and has never had any recurrence of the ascites, although his former alcoholic habit has improved but moderately. In September, 1901, he entered the hospital again for a suppurative inguinal adenitis secondary to an infecting venereal lesion of the prepuce. Removal of both parts was attended with prompt healing. When in the ward convalescing from this operation; a third picture (Fig. 2) was taken; and we requested Dr. George A. Tuttle to again examine the patient in order to note any changes which might have occurred since his former report of the case made three months after operation. Dr. Tuttle writes as follows:

"I examined J. C. to-day, and find on comparison that there are practically no changes to be made in the report of January 6,

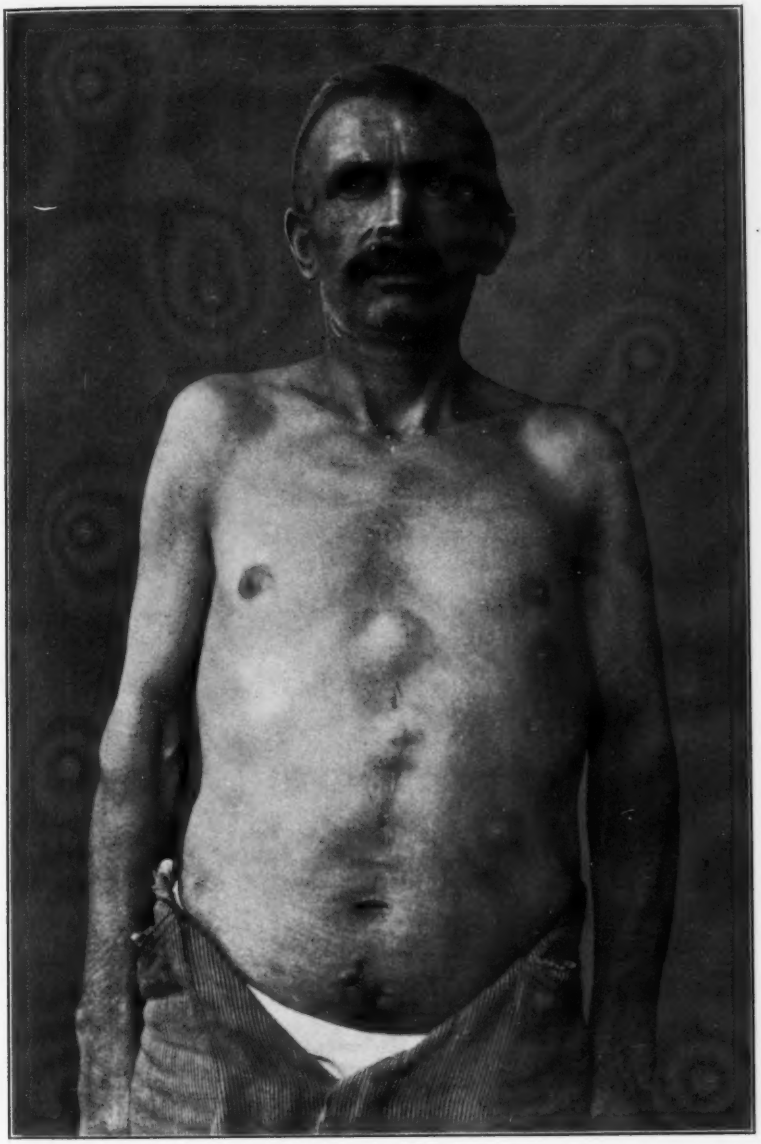

FIG. 3.—J. C. February 1, 1902. Two years and five months after operation, showing supra- and infra-umbilical cicatrices.

CORRECTION.

For the first two lines of the foot-note on page 195, of the August ANNALS OF SURGERY, substitute the following :

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[1] "The operation of Dr. Emil Ries on August 18, 1899, being done for intestinal hæmorrhage and not ascites, as he explained in the following courteous and very interesting letter."

1900. There are slight hernial protrusions both above and below the umbilicus where the incisions were made. The heart and liver are in the same position noted in the former examination.

"I found no evidence of fluid in the abdominal cavity. My impression is that his general nutrition is not so good as when I examined him before. At that time he was still in the hospital and living regularly, while now he has hardly recovered from his recent trouble."

At the meeting of this Society on December 13, 1899, I presented this same patient. At that time, three months had elapsed since I had performed Morrison's operation. The case was duly reported in the ANNALS OF SURGERY, Vol. xxxi, page 489, under the caption, "Cirrhotic Ascites treated by Peritoneal Anastomoses." Again, in a paper entitled "The Surgical Treatment of Ascites due to Cirrhosis of the Liver," it was published in the *Medical and Surgical Reports of the Presbyterian Hospital for 1900.* But until Dr. G. E. Brewer's recent paper, "The Surgical Treatment of Ascites due to Cirrhosis of the Liver," *Medical News,* February 8, 1902, the case had not been cited in the tabulated lists of any of the fairly numerous articles appearing since the compilation of fourteen cases already alluded to as made by the speaker in 1900, and referred to here in brief. Consequently, I have felt inclined to seek an opportunity to show the patient again after an interval of two and a half years, and to put on record the first case in this country[1] where a systematized effort was successfully

[1] "The case of cirrhosis of the liver on which I performed Talma's operation on August 18, 1899, was operated on on account of daily hæmoresting letter:

"100 STATE STREET, CHICAGO, October 21, 1901.

"The case of cirrhosis of the liver on which I performed Talma's operation on August 18, 1899, was operated on on account of daily hæmorrhages from bowel, and had no ascites. In the course of the operation adhesions of great vascularity were found between right lobe of liver and parietal peritoneum. These were, of course, not disturbed. Omentum was stitched to anterior abdominal wall. After one week patient could leave hospital. She has been seen last in June of this year in perfect health, weighing 170 pounds (gain of thirty pounds since operation); she is able to earn her living by hard work, and has neither hæmorrhages nor ascites."

undertaken to cure a rapidly recurring ascites by a surgical operation.

In the paper which I published in the *Report of the Presbyterian Hospital for 1900*, I reviewed more or less fully fourteen cases of Talma's and Morrison's operation, and found that seven, or 50 per cent., appeared to belong to the division headed greatly improved or cured, namely,—

Cases Reported.		Greatly Improved or Cured.	
Van der Meulen	1		
Schelkley	1		
Lens	1		
Drummond and Morrison	4		2
Talma	1		1
Weir	1		
Rolleston and Turner	2		1
Bossouski	1		1
Neumann	1		1
Brown	1		1
	14		7

As the result of my examination of the records of these cases, I made the following observations:

"We feel assured that the great risks attending operation on advanced and failing cases of ascites due to cirrhosis will be notably wanting in similar procedures applied in earlier stages of the disease.

"Some impressions derived from these reported cases and observations of our single patient may be summarized as follows, presuming, of course, that we are dealing with pretty straight cases of ascites due to cirrhosis of the liver.

"(1) The more rapid have been the accumulations of ascitic fluid, the greater the reason to provide for long-continued drainage which is to follow the operation, and to expect that very gradual improvement in all symptoms is the most and best which can be hoped for.

"(2) In these advanced and apparently hopeless cases of rapidly recurring ascitic accumulations, the three things of greatest import appear to be:

"(*a*) The full appreciation before operation of the neces-

sity and the provision for a constant and thorough aseptic pelvic drainage.

"(*b*) The general observance of a rational and aseptic operative technique, such as that used in the third case of Mr. Morrison, and which we followed quite closely in our case. In other words, the readiness to forego the introduction of personal innovations until those methods which appear reasonable shall have been proven faulty.

"(*c*) The value of Morrison's adhesive strapping to keep in approximation the denuded peritoneal surfaces, and at the same time to compel the serous effusion to find its only available space in the pelvis, appears to us most evident. The importance of the long continuance of this device we had accentuated on two occasions, when a hospital interne attempted at the end of four weeks and again later to dispense with the adhesive strapping. Each time an accession of ascitic fluid to the upper part of the peritoneal cavity was apparent.

"(*d*) An unusual vascularity of the granulation tissue forming the infra-umbilical fistula was shown on several occasions, especially during the last stages, at dressings, by so considerable a hæmorrhage as to require instant plugging. From this the writer has inferred that an important and considerable part of the anastomotic circulation may in this patient's case be maintained by this particular band of adhesions."

CONGENITAL DISLOCATION OF HIPS.[1]

WITH REPORT OF CASES AND DESCRIPTION OF A PELVIS OBTAINED THREE YEARS AFTER SUCCESSFUL REDUCTION BY THE LORENZ METHOD.

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It is not my purpose to go into a long historical sketch. A history of all the more important work done on this subject can be found in the classical monograph of Lorenz and other articles enumerated in the appended references. Neither do I wish to waste any time on the question of priority, and yet I cannot pass the matter by without the observation that, after having made a rather careful study of the whole matter, it would seem to me that an entirely unprejudiced outsider could scarcely help being impressed with two facts, namely, (1) That Lorenz was the first to accomplish reduction and reposition in one sitting under deep narcosis by careful and intelligent manipulation instead of employing long continued extension or the action of an unintelligent machine. (2) That he was the first to make use of the muscles extending from the pelvis to the femur, and the weight of the body in retaining the head in the acetabulum, and developing an acetabulum in the normal location, which later would become practically perfect functionally and anatomically.

In the early part of the year 1896 it was my good fortune to be present at a meeting of the Vienna Medical Society, when

[1] Read before the Chicago Surgical Society, June 2, 1902.

Professor A. Lorenz exhibited his first series of cases successfully treated by his "Bloodless Functional Weight Method." Later in the year I was granted the privilege of witnessing one of the first and most enthusiastic followers of Lorenz, Dr. Kuemmel, of Hamburg, successfully treat a number of cases of congenital dislocation of the hip.

To witness the work of such masters naturally aroused my interest in the subject, and led me to attempt reduction in the cases that have since come under my care. A detailed report of these cases will be found later in this paper.

Frequency.—In reference to the relative frequency of congenital dislocation of the hip in proportion to population or even to other affections, it is very difficult to obtain definite information. There are various factors which make such statistics quite unreliable. In the first place, many of these cases have gone undiagnosed and are still overlooked. I have been able to find but two articles in which the author tried to establish the relative frequency of this affection to population. At the Paris Maternity, in 23,292 new-born, this affection was observed only once. Of course, it must always remain a question as to how carefully it was looked for in the other 23,291 cases. One observer noted the condition three times in 332 autopsies on new-born. In the Hospital for Ruptured and Crippled, New York City, it was observed twenty times among 9000 patients treated during the year 1890. Dallinger, among 859 orthopædic patients, observed the condition nine times, or in 1.1 per cent. Hoffa, in 1444 orthopædic cases, seven times, or in 0.49 per cent. At the Augustana Hospital, between May 1, 1897, and May 1, 1902, among 6296 patients, I observed four cases. One observer states that it is the most common congenital dislocation, being about nine times as frequent as all others combined; another states that it is more common than club-foot.

Though the above figures vary greatly—as they necessarily must, according to the reputation the various surgeons have developed—they all agree in the one fact: That the con-

dition is not at all uncommon; in fact, much more frequent than most of us have hitherto been inclined to believe.

Etiology.—As far as I am able to ascertain, but little is known about the etiology of this condition. The following causes are the ones most usually given:

(1) Injury to the mother during pregnancy, thus injuring fœtus in utero.

(2) Abnormally small amount of liquor amnii, and consequent forced abduction and flexion of thighs during a long period of intra-uterine life.

(3) Injury at time of birth.

(4) Retardation of growth of the acetabulum.

The last is simply begging the question. The third is not probable, because it has been demonstrated over and over again that it is easier to produce a fracture at the neck of the femur than a dislocation of the hip at time of birth. The correctness of the first and second has so far been neither absolutely proven nor disproven; but that there must be some yet unknown factor at work is almost positive, because none of the above enumerated causes give us any clue as to why the condition should occur about seven times as often in girls as in boys.

Pathology.—All observers seem to agree that when present the acetabulum is always in the right place, and the most experienced state that, however rudimentary the acetabulum may be, it is always present. If the patient is old, and the dislocation consequently of long standing, the acetabulum is always more or less completely filled with cartilaginous, fibrous, or fatty substance. The head is usually of normal, or nearly normal, size, and consequently it is always disproportionately large. The neck is usually short and thick, and often placed at an abnormal angle to the shaft. Sometimes the angle is greater and sometimes less than normal. The ligamentum teres may be absent, or it may be drawn out into a long, thin band. At times it is even hypertrophied. It is more often absent in double than in single dislocations. The capsule is necessarily greatly elongated, and often has an hour-glass constriction at its middle. This constriction may be almost

imperceptible, or it may be so pronounced as to nearly completely divide the capsule into two distinct halves. The capsule may be adherent to all or a part of the circumference of the rim of the acetabulum. In double dislocations the pelvis hangs on the femora by the drawn-out capsule instead of resting upon and being directly supported by the heads of the femora. The pelvifemoral and pelvicrural muscles are shortened, while the pelvitrochanteric muscles may be lengthened in extreme cases.

Signs and Symptoms.—The signs and symptoms differ somewhat according to whether the dislocation is single or double. For convenience I have divided them into three groups.

Group one comprises those common to both forms of dislocations; Group two, those which are found only in double dislocations; and Group three, those which are found only in single dislocations.

Group 1.—Prominence of the buttocks. This is sometimes very marked, having the appearance of a lipomatous tumor. The upper border of the great trochanter projects well above Nélaton's line. The head can be felt on the posterior surface of the acetabulum, and there is a depression instead of a prominence in the groin just external to the femoral vessels. If the pelvis is grasped firmly and traction is made on the thigh, the head can be felt to move downward without imparting the motion to the pelvis, *i. e.*, undue passive motion at hip, though active motion is usually about normal. The patients learn to walk late, fall easily at first, are easily fatigued, and when they become very tired often experience a dull, aching pain at the hip and knee. A good skiagraph always shows the dislocation.

Group 2.—Waddling, duck-like gait; more or less marked lordosis; prominence of abdomen; squat figure. The last can be determined by careful measurements. It can always be demonstrated that there is a disproportion between the distance from the anterior superior spines of the ilium to the internal malleoli and the height of the body. This can be seen from the case reported below in detail.

Group 3.—Marked limp; pronounced scoliosis; shortening of affected limb as determined by measuring from anterior superior spine to internal malleolus.

Diagnosis.—If in each individual case of deformity of the hip or back we will but remember the possibility of its being a congenital dislocation of the hip, and recall the above enumerated signs and symptoms, the diagnosis is usually easy, as in each case all or nearly all of them can be found. In the past a goodly number of these cases have been diagnosed coxitis, simple spinal curvature, infantile paralysis, rickets, or Pott's disease. One of the cases reported below had been diagnosed as infantile paralysis by several specialists, while another had been diagnosed coxitis.

Until the advent of the X-ray quite a number of cases of coxa vara had been diagnosed as congenital dislocation of the hip.

Although these errors have undoubtedly often been made in the past, and are still occasionally made, they need not be made by those who in any way have had the subject called to their attention.

Treatment.—In order not to make the paper too long, I have decided to confine myself exclusively to a consideration of the "Bloodless Functional Weight Method" of Lorenz. Evidently, for the sake of convenience and clearness, this author has described his procedure as occurring in four distinct acts, namely, reduction, reposition, formation of acetabulum and restitution of function. This ultra-schemetic arrangement gave me some trouble when I tried to adapt it to an actual case in practice. I gained the impression from my reading that these different acts should follow each other in regular order; but I soon found that some of them at least occur more or less simultaneously, as will readily be seen from the following:

Reduction is accomplished by traction upon the affected limb. In small children manual traction may suffice. The first important condition required is general anæsthesia pushed to complete relaxation of the muscles. This accomplished, the pelvis is held firmly, while even, continuous, steady traction is

applied to the limb, grasping it either a little above the ankle or a little above the knee. The pulling must continue until the upper border of the great trochanter is well down to the level of Nélaton's line. In older children a tackle and windlass arrangement becomes necessary unless one has several well trained assistants, and even then I think I should prefer tackle and windlass, as the amount of force applied can be more accurately gauged.

The perineum is placed against a firm, well-padded support. For this purpose I have found an inflated Barnes's bag the most satisfactory. A piece of cotton is now placed about the limb just above the ankle, and a skein of wool is tied about this with a surgical knot, so as to avoid constriction and impairment of circulation. The skein of wool is then fastened to one of the pulleys of the pulley and tackle arrangement, while the other pulley is fastened to spring scales and the scales to a fixed point in the room. The rope is fastened to the windlass, and this is now slowly set in motion. The scales are read every half minute by one assistant, while another announces the frequency and character of the pulse every two minutes, and oftener if there is a sudden change.

If the reduction is very difficult, it is necessary to interrupt the traction at intervals not to exceed ten minutes. As soon as the upper border of the great trochanter is well down to Nélaton's line we may consider this part of the work accomplished and proceed to the next step, which consists of placing the head into the acetabulum. This is often the most difficult part of the procedure, and upon its accomplishment depends the future of the case. If we fail in this the case may be looked upon as one not suited for this method of treatment. If it succeed, we may have reasonable hope of ultimate success. The chief causes of failure seem to be: (1) The shortening of the adductor muscles. (2) Hour-glass constriction of the capsule. (3) Adhesions of the anterior portion of the capsule to the rim of the acetabulum. The first naturally interferes with abduction, which is so necessary in making the head slip over the posterior rim of the acetabulum. This difficulty is

usually overcome by steady moulding manipulations. If one be but persistent, one can in a short time abduct the thigh to a right angle. Sudden jerks must be avoided, as these are very prone to cause fracture of the neck. If abduction to a right angle cannot be accomplished, subcutaneous or open tenotomy of the abductors must usually be resorted to. As soon as the required degree of abduction has once been accomplished, the pelvis is steadied by an assistant, the thigh is flexed to a right angle and rotated inwardly slightly. While one hand of the operator presses on the trochanter, the other hand makes strong, steady traction forward, and at the same time attempts slow abduction. The head slowly creeps up over the posterior border of the acetabulum, and suddenly slips over the rim, bounds into the acetabulum with a distinct thud, which sometimes can be heard at a considerable distance, and a vibration of the patient's body, which is always transmitted to the operator, and sometimes even to the table and to those who may be in contact with it.

The other symptoms of an accomplished reposition are: Distinct lengthening of the thigh; the development of a fulness in the groin, and the disappearance of the head on the posterior surface of the ilium; and the sudden tenseness of the hamstring tendons characterized by inability to extend the knee. The object of the inward rotation is to overcome the second and third great difficulties, namely, to loosen the capsule from the rim of the acetabulum and to utilize the head of the femur as a wedge to open up the hour-glass constriction in the capsule. Reposition having been accomplished, we must now make every effort that this be rendered stable. This is secured, first by a boring motion. The thigh is rotated outward, and with a boring motion the anterior capsule is stretched and the acetabulum deepened; second, the tense pelvifemoral and pelvicrural muscles will help to deepen and enlarge the acetabulum; and, finally, third, the weight of the body in walking will greatly aid the formation of a satisfactory joint in removing the deposits in the acetabulum and securing the development of a broad cotyloid ligament. In order to fully utilize this important prin-

ciple, a cast must be very carefully applied. It is best applied over a pair of tightly fitting wool trousers, and should include the whole thigh and the trunk to the level of the navel. In order to avoid backward dislocation until the acetabulum has had a chance to develop, the cast is applied with the thigh slightly over-extended, and a degree of abduction sufficiently great to secure against the possibility of the head slipping out of the rudimentary acetabulum. Usually about ninety degrees of abduction are required.

In single dislocations a high sole is now placed under the shoe of the operated leg, and the child is allowed to walk just as soon as it wishes. It will usually attempt to walk when the pain caused by the treatment has subsided. This will vary from one to two weeks. In double dislocation, where one hip is reduced at a time, exactly the same line of treatment is followed. The second hip can be reduced about a year after the first. If both reductions can be made at the same sitting, a small stool is made for the child, on which it can sit astride comfortably and still bear some weight on the feet. The first cast is left in place for from four to five months, when it is removed, and the extremities are brought down to about forty-five degrees of abduction with slight flexion. This cast is left in place for about six to seven months, when the child can usually be allowed to go without any appliances. During most of this time the child has been up and about. This form of ambulating treatment fulfils a threefold purpose: It develops a stable joint, secures normal motion in this joint, and during the entire course of treatment the patient will secure enough exercise to keep in a healthy condition.

The treatment just outlined is the typical method which should first be attempted, and which will be found successful in a considerable proportion of cases. Sometimes recourse to slight modifications must be taken, but a detailed description of these would make the article too long.

Prognosis.—If untreated, the prognosis is always quite bad. There remains an unsightly deformity which persists throughout life. That in itself is a serious affliction, especially

for girls, who are the most frequent sufferers. But this is by no means all. The power of endurance is nearly always somewhat, often greatly, reduced. The older the patient becomes, the less the endurance. Besides, there is no way of telling at the age of five, for instance, which child will get along fairly well and which one will be a great sufferer in later years. Lorenz quoted Halsted as stating that 31 per cent. of all patients suffer pain, especially severe when fatigued. The pain may be slight, or it may be so severe as to incapacitate the patient for all work requiring walking or standing; or it may remind one of coxitis, as in Case I of our series reported below, which had been repeatedly so diagnosed. Bradford reports five cases in women in his own practice who suffered severe pain when they tried to walk a mile at a stretch. If the patient is submitted to the bloodless operation before the age of six in double and ten in single dislocations, the prognosis is very much better. In 212 carefully observed cases treated before January 1, 1899, Lorenz reports 108 anatomically and functionally perfect results, 102 anatomically imperfect, but functionally good results. Julius Wolf up to January 1, 1899, had treated 103 patients with 145 dislocations. Of these he reduced 115 joints in ninety-six patients successfully by the Lorenz method.

In 450 attempted reductions, Lorenz had one gangrene of thigh, one death from chloroform, two from combined shock and chloroform, and eleven fractures of neck of femur. This looks like a rather discouraging array, but we must not forget that all these accidents occurred in patients beyond the age limits above given and during the developmental period of this method of treatment. It must impress us with the necessity of great caution when the patient is older, and the duty we owe these patients in urging the reductions before the age limit is reached.

Within the proper age limit only the following minor accidents occurred: One fracture of the horizontal part of os pubis, one fracture of crista ilii, three peroneus paralysis. All of these subsided spontaneously. There are still a few

surgeons who deny the possibility of a bloodless reduction; yes, one or two who scoff at the idea. There are a greater number who, although admitting the possibility of a bloodless reduction, doubt the permanency of the cure. In order to do my mite in convincing these, I take the liberty of describing in detail a pelvis obtained from a patient who died on November 27, 1901, upon whom I had done the Lorenz bloodless reduction on the hips about three years previously.

In order that I may illustrate some statements made above, and in order that the report may be complete, I will briefly rehearse the cases that have come under my care. For the sake of convenience, I will report the first case last. The others appear in the order in which I saw them.

CASE I.—Single lady, thirty-five years of age. Always lame in left hip. Being of poor parents and later a servant girl, no special attention was paid to the condition. For the past few years has suffered a great deal of pain in hip, especially after severe exertion. Came to hospital with diagnosis of coxitis. Typical congenital dislocation of left hip as determined by all above-enumerated signs and symptoms, including skiagraph. Rest in bed with Buck's extension. Pains subsided in about two weeks. Have not seen her since she left the hospital.

CASE II.—Well-developed, healthy girl, ten years of age. Typical congenital dislocation of left hip. Though repeatedly examined, a diagnosis had not previously been made. Three attempts at reduction and reposition were made at intervals of a week, extension applied up to eighty pounds, but unable to bring great trochanter down to Nélaton's line. Patient was subjected to this treatment eighteen months ago. No more discomfort now than before the attempted reduction.

CASE III.—Well-developed, healthy girl, six years old. Typical dislocation of both hips. Child very easily fatigued, and when fatigued suffers considerable pain in both hips. Repeated efforts had been made by parents to ascertain the nature of the trouble, but up to date no diagnosis had been made. Two attempts at reduction, September 20, 1901, and October 10, 1901, respectively. Both failed. Unable to get great trochanter down to Nélaton's line, though seventy-five pounds of extension were applied for as

long a time as the patient's pulse seemed to warrant. No worse than before, since attempted reduction. Both of the above cases were just about at the age limit when the attempts at reduction were made.

CASE IV.—Well-developed girl, four years old, with double congenital dislocation of hips. No special inconvenience. Marked deformity and waddling gait. Seen only a few weeks ago. No attempt at reduction made as yet.

CASE V.—Well-developed, healthy girl, seven years old. Congenital dislocation of left hip. No special discomfort except limp. Seen one week ago. No attempt at reduction made as yet.

CASE VI.—On October 24, 1898, a little girl, four years and three months of age, presented herself for examination, and for treatment, if in our opinion it seemed possible to give her parents any encouragement in the matter. At that time I elicited the ensuing history and noted the following conditions: Family history very good. No history of similar trouble or of any deformity among the members of the family or of any of the ancestors or relatives. Born at term, labor very easy, but mother noticed that there was much less liquor amnii than with former pregnancies. Weighed six pounds at time of birth, apparently perfectly healthy. No history of injury to mother during pregnancy or to child after birth. Mother had been very weak during the pregnancy, as this was the third child in three years, and she nursed the previous one until five months before this one was born. Mother had not noticed anything unusual during this pregnancy, except that she thought she had not "felt as much life" as during the two previous pregnancies. During the first three months the baby had two very severe attacks of cholera infantum. Mother noticed nothing peculiar about child except the hips seemed rather prominent. The child did not attempt to walk until she was two years old, and when she did she began by walking on all fours, and continued this for a long time, especially when in a hurry. Later, when attempting to walk erect, she was very unsteady and fell very easily. She was two and one-half years old before she could walk the length of the room without falling. She had always been very easily fatigued.

On examination I found a well-nourished child, rather small for her age, only 87 centimetres tall, with the distance from the anterior superior spines of the ilia to internal malleolus of each

side 39 centimetres. Heart, lungs, and abdomen negative. Digestive and excretory functions normal. On directing her to walk, the prominence of the hips, the marked lordosis, the protrusion of the abdomen, and waddling gait immediately attracted my attention. On closer examination, the upper borders of the great trochanters were found 5 centimetres above Nélaton's lines; the heads could be felt on the posterior surfaces of ilia instead of in

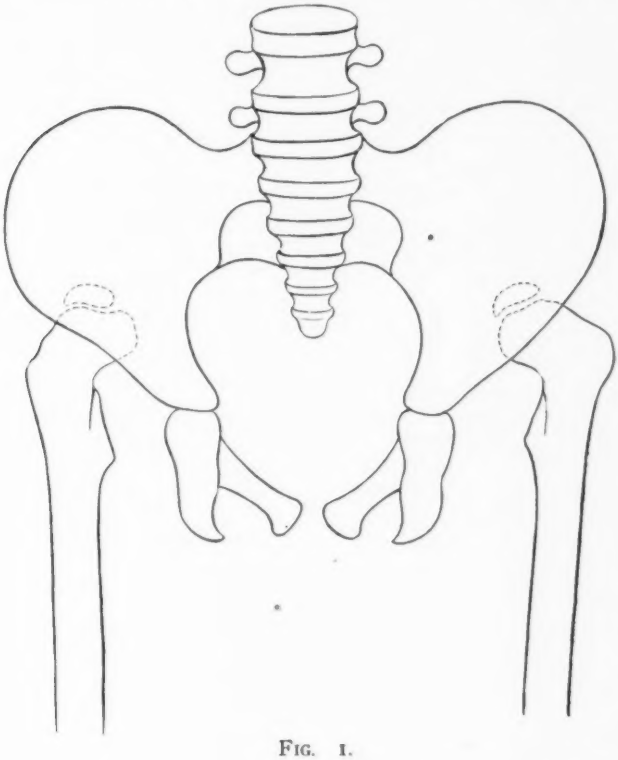

FIG. 1.

the groin; there was hypermobility of the heads of the femora and of the thighs.

On these findings and this history, we of course immediately made a diagnosis of double congenital dislocation of the hips, as a more typical case could scarcely be found. In order to make doubly sure, and in order to get an idea of the condition of the upper ends of the femora and the acetabula, and hence as to probable prognosis,—for at that time it was still thought that the

X-ray could give valuable information on this point,—we had the skiagraph taken of which Fig. 1 is a pen sketch. On close observation we note that the heads are about half-way between the anterior superior and the anterior inferior spires of the ilia instead of being opposite the Y cartilages, which are shown by lighter lines in the skiagraph. Heads and necks appear well formed and the acetabula fairly well developed.

The degree of displacement becomes more evident when we compare Fig. 1 with a skiagraph of the pelvis of a normal child of about the same age, or with Fig. 5, an exact pen sketch of the skiagraph taken after complete recovery.

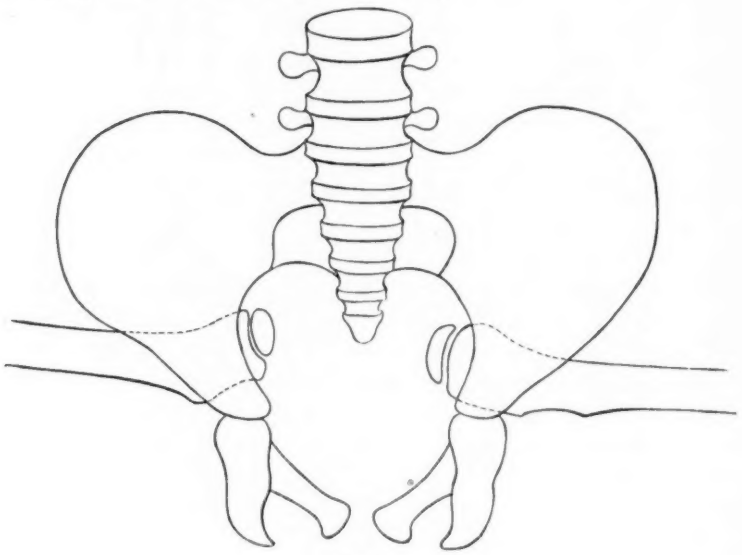

FIG. 2.

We now proceeded to treatment, and we tried to follow the directions of Lorenz as closely as possible. At that time he still advised Buck's extension for a short period. We accordingly applied this for five days, when we anæsthetized the little patient, placed a skein of wool over the perineum and tied the ends to the upper end of the table. Another skein of wool was fastened around the left ankle. The latter was now attached to a tackle and windlass arrangement, which was then slowly put in motion, and under careful watching of the pulse and respiration and with repeated intermissions, in the course of about twenty-five minutes

the left lower extremity was brought down until the upper border of the great trochanter was slightly below Nélaton's line. The force applied never exceeded fifty pounds, as tested by spring scales.

The extension was now relieved, the thigh was carefully abducted to a right angle by slow, steady, moulding manipulations. The thigh was now flexed to a right angle, and while

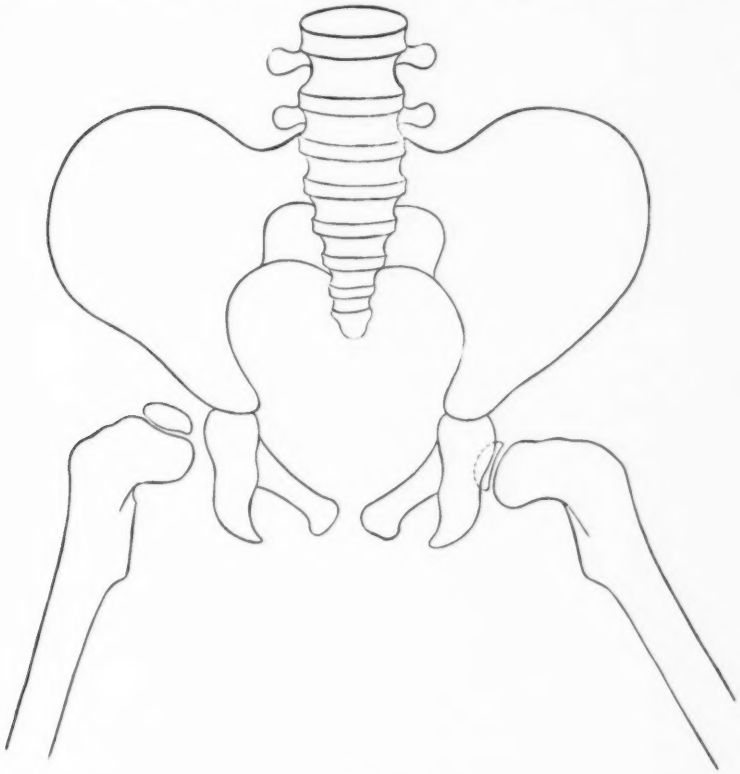

FIG. 3.

traction was made in this direction with the left hand, pressure was made on the great trochanter with the right and the thigh was slowly abducted and over-extended. At this point the head was felt to slide over the posterior ridge of the acetabulum, and with a dull thud and a plainly felt shock or vibration the head slipped into the acetabulum and the reduction was accomplished. This was accompanied with a noticeable lengthening of the left

thigh, the appearance of a fulness in the left groin, and the disappearance of the head on the posterior surface of the ilium. On attempting to reduce the angle of abduction, reluxation immediately took place. Reduction was easily accomplished with the same characteristic signs. With a boring motion an attempt was now made to enlarge the acetabulum and to stretch the anterior portion of the capsular ligament by pressing the head forcibly

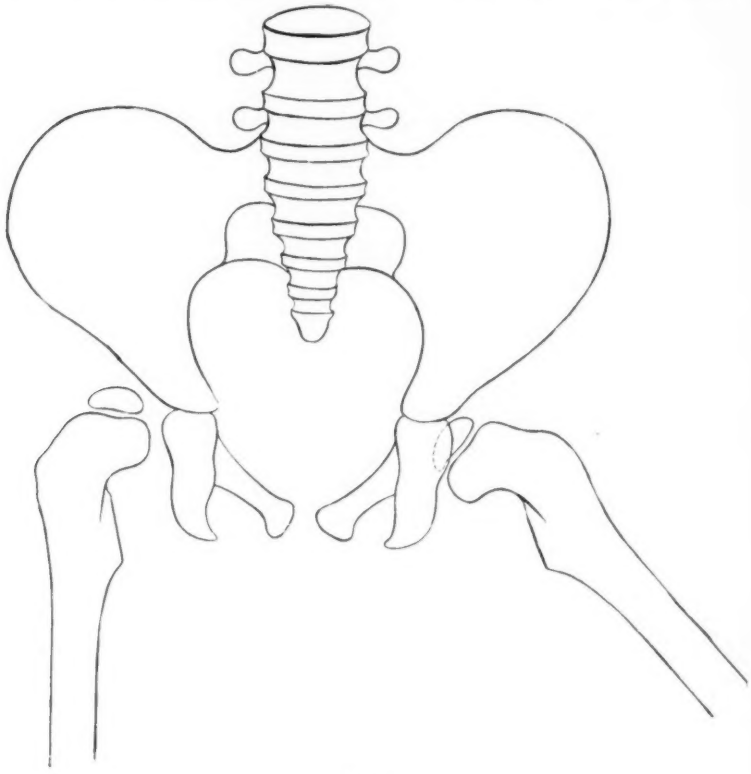

FIG. 4.

against it, hoping in this way to secure greater stability. The left thigh and the trunk to the level of the ribs were now incased in a thin layer of cotton and a plaster-of-Paris cast applied with the left thigh abducted to ninety degrees in slight over-extension. No attempt was made to further test the stability or to reduce the angle of abduction. One week later the cast was removed, and the right reduction accomplished in the same manner and with

the same unmistakable signs. Both thighs and trunk up to the ribs were then incased in cotton and a cast applied.

I now had a skiagraph taken through the cast, which, though somewhat blurred, showed the heads in excellent position and evidently reduced. This negative, with several others, was unfortunately broken, and I am unable to give a sketch of it.

The patient was allowed to return to her home on the 10th

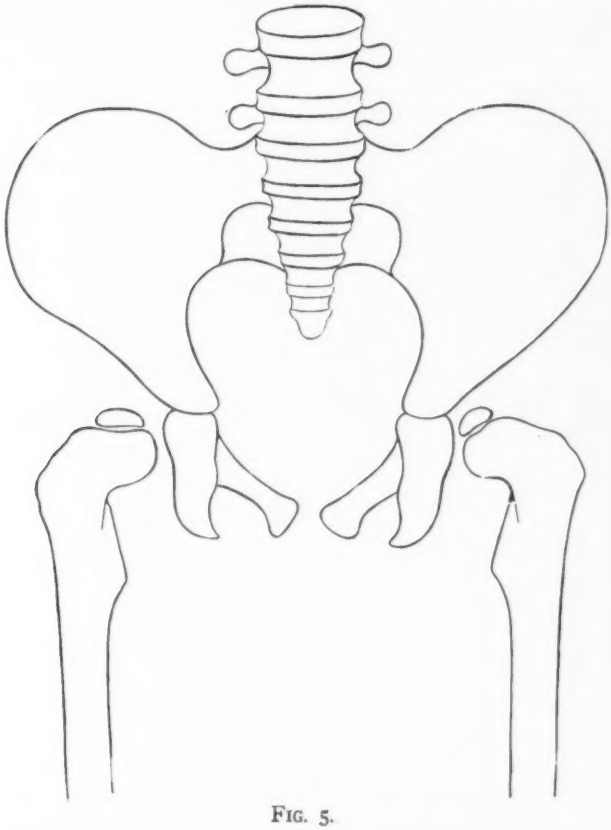

FIG. 5.

of November, with directions to return in about a month. With this request she complied by returning on December 12. The cast was now removed, and the depression instead of the fulness in the groins was immediately noticed. The heads could again be felt on the posterior surfaces of the ilia. The skiagraph confirmed my fear that a backward redislocation had taken place. Fig. 2

represents the condition found at the time and shows the position in which the cast has been applied. The following day the patient was again anæsthetized; both dislocations were reduced with but little difficulty and with the same characteristic phenomena. The cast was again applied with the legs in the same position, but with greater care. The child was allowed to go

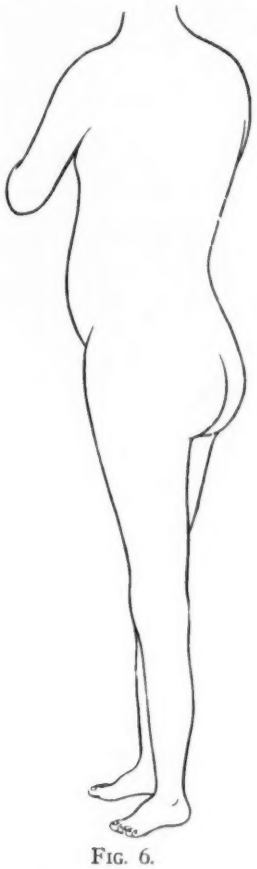

FIG. 6.

home on December 17, 1898, and returned to the hospital on January 16, 1899. At this time I again found that reluxation had taken place. Once more the patient was anæsthetized and reduction accomplished as on the previous occasions. I had seen Kümmel use felt under his plaster of Paris, and when I began the treatment of this case I tried to procure this material, but for

some reason was unable to do so. I now concluded that the cotton, which could not be absolutely uniformly applied, and which would yield to any sudden jar, must be the cause of the reluxations. In the absence of felt, I procured some medium weight, snugly fitting, all-wool drawers and applied the cast over these with both thighs abducted to ninety degrees and slightly over-extended. The patient went to her home on January 25 and returned on February 27, and to my great satisfaction the physical findings indicated that the heads were in place, though the skiagraph was not per-

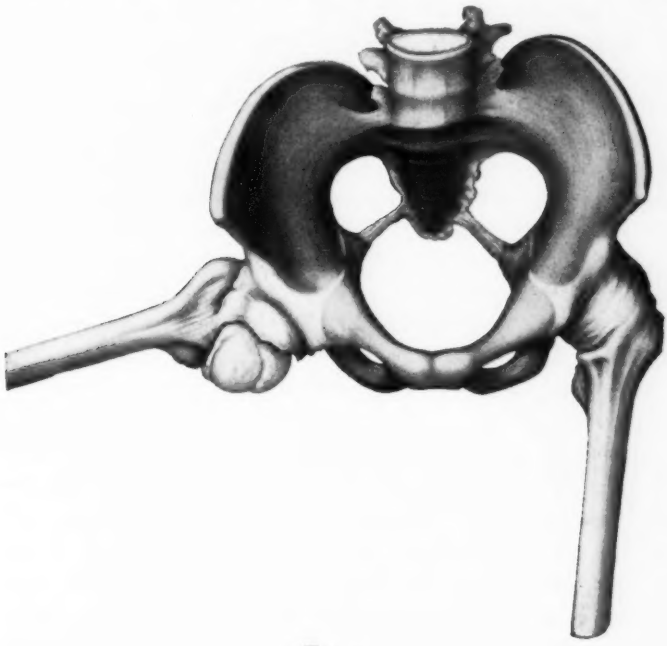

FIG. 7.

fectly satisfactory, as it left us in some doubt. We concluded, however, that the heads were in place, and future developments have proven the correctness of this belief.

The difficulty about the ordinary skiagraph is that it does not give us perspective, and in congenital dislocation of the hips, especially when the limbs are held at ninety degrees abduction, lateral views are manifestly impossible. If we at that time had had stereopticon views, I am confident it would have cleared up all doubt.

This negative was also broken, and I regret greatly that I cannot produce a sketch showing the heads in place at this time.

The child was now allowed to sit up on her little stool and to play around at her pleasure. With two changes of cast, the limbs were left in approximately this same position until August 2, 1899, when the patient was again anæsthetized and an attempt made to bring the thighs down into the midposition of Lorenz, namely, abduction of about forty-five degrees, with very slight flexion. This was accomplished quite readily on the left side, but the right side offered great, and at first apparently insurmountable, resistance, the head seeming to catch on the lower border or lip of the acetabulum, and I succeeded in bringing the limb down only a very little. A cast was now applied and allowed to remain until January 1, 1900, when the patient was again anæsthetized and the position represented in Fig. 3 was secured. In this you see we have accomplished a great deal with the left thigh, and the right thigh is almost in the midposition of Lorenz. With four more changes of casts we obtained the position represented in Fig. 4 by August 27, 1900. By this time the left thigh was in normal position and motion all but perfect, so that it could be left out of the cast. The right one gave a great deal more trouble. There was still marked rigidity and abduction and a decided tendency to contracture (flexion) at the hip; hence I was compelled again to anæsthetize the patient and to forcibly overcome the contracture and to apply a cast with the right thigh in the position of normal extension and about ten degrees of abduction, which I could not overcome without applying an undue amount of force. This cast was left in place until November 10, when it had become soft, and had to be replaced by a stronger one. At this time the last skiagraph, which is represented by Fig. 5, was taken. This shows the heads in their normal position opposite the Y ligaments, well below the anterior inferior spines of the ilia. January 1 the cast was removed for a day, when there seemed to be a tendency to contracture of the right hip, and the same cast was reapplied, and removed only for half an hour daily. This time it was gradually lengthened, and February 15, 1901, the cast was permanently discarded.

By this time the muscles of the left thigh had developed nicely, and now, with exercise and gentle massage, the muscles of the right thigh also developed rapidly, so that October 2, 1901,

I received the following letter from the mother, the patient having removed to Colorado in the meantime. The mother states: "The child is the picture of health and walks beautifully. The stiffness is almost entirely gone from the right hip, and you would be surprised to see how nearly perfect her walk is. . . . She is the greatest mountain-climber in the family, as she never gets short of breath and never complains of her limbs being tired."

Subsequently I was told that she had learned to skip rope of her own accord and to sit tailor-fashion without difficulty. At about this time I had a profile photograph taken, of which Fig. 6 is a pen sketch. Though the patient is leaning forward a little, there is not a trace of the former lordosis, the curve of the back is perfectly normal, there is no prominence of the hips nor any abdominal protrusion whatsoever.

I had hoped that at this time I would be able to describe the patient's condition from personal observation, in order to prove that a perfect functional result can at times be obtained without operative interference; but this was not to be, for on November 27, 1901, she was suddenly taken ill with some acute intestinal disturbance, and on November 29 she died in convulsions. I am, however, in a position to do that which from a scientific standpoint is more important and more convincing than description of the patient or the exhibition of skiagraphs, namely, a description and illustration of the pelvis, which I removed at post-mortem, December 1, 1901.

Before giving a detailed description of the joints, I wish to give the notes Dr. Espy, of Trinidad, Colorado, kindly took down for me at the time I made the autopsy.

Total length of body, 109 centimetres.

Right anterior superior spine to right internal malleolus, 52½ centimetres. Left same.

Greatest circumference right thigh, 27½ centimetres.

Greatest circumference left thigh, 28½ centimetres.

Greatest circumference right calf, 19 centimetres.

Greatest circumference left calf, 19 centimetres.

Right hip easily flexed to 85°, extended to 180°, and abducted to 40°, and adducted so as to place leg readily on left knee.

Left hip easily flexed to 70°, extended to 180°, abducted to 45°, and adducted same as right.

Some rigor mortis. Abdomen not distended. Intestines,

spleen, kidneys normal. Considerable glairy mucus in the stomach.

Having promised to do nothing which might later interfere with the easy management of the corpse, I had to limit my investigation to a superficial examination of the thoracic viscera through an incision in the diaphragm and to an examination of the hip-joints. In order to do the latter more thoroughly at my leisure, and to have the specimen as proof positive of the possibility of a reduction, I persuaded the parents to permit me to remove the pelvis and the femora. In removing these, I examined the muscles and tendons about the hip-joints, and so far as I could tell they were perfectly normal. There was no evidence of healed lacerations.

On examining the specimen, of which Fig. 7 is an accurate reproduction, we note the following facts: The pelvis is well formed and apparently of normal size. The individual bones of which it is composed are held together firmly by strong ligaments. The capsular ligaments are well developed and hold the heads firmly in the acetabula. No abnormal sliding motion possible. The heads of the femora are opposite the Y cartilages. A straight line drawn through the two Y cartilages passes apparently directly through the centre of the heads and about one-half centimetre below the upper borders of the great trochanters. The upper borders of the heads are well below the anterior inferior spines of the ilia. The lower borders of the heads project fully one-half centimetre below the level of the iliopectineal eminences. So far this description tallies almost perfectly with that of a normal pelvis which I obtained from a female patient of about the same age. In the latter the Y cartilages seem to be relatively a little nearer to the anterior inferior spines.

In order to determine the condition of the reduced joint itself, I opened the right one by a semilunar incision, severing the capsular ligament for about the lower half of its extent. The neck is strong, of about normal length; the angle between it and the shaft may be a trifle less than that of the ordinary femur. The head is a little larger than normal, not perfectly globular, but on its anterior inferior and mesial surface it has the appearance as though a shell of a small sphere had been superimposed. The whole articular surface is covered by a perfectly smooth layer of cartilage. The capsular ligament is strong and hugs the head

and neck closely. The acetabulum is well developed, almost, if not quite, as deep as normal. It has a well-formed solid rim. The cotyloid ligament is present and apparently normal. The articular surface is perfectly smooth. There is no definite ligamentum teres to be found.

At the bottom of the acetabulum I found a thin, paper-like structure about four millimetres wide and 1.5 centimetres long, one end attached at the place the ligamentum teres is normally inserted in the acetabulum, and the other end free. Whether this may be looked upon as the remnant of the ligamentum teres, I am unable to say.

The most interesting and wonderful feature of the specimen, to my mind, is the way in which the capsule has adjusted itself to the new conditions. When we again turn to Fig. 1, it must be plain that at the beginning of the treatment the capsule must have been drawn out in the form of a long tube, which now has retracted to the normal shape. This is simply an additional proof of the wonderful power nature has to adjust matters, and the inherent tendency of the individual members of the human body to attain to a certain normal status.

In conclusion, let me observe that from the very beginning of treatment I considered this a rather favorable case. A strong, healthy child, with apparently well-developed femora, and fairly well-developed acetabula, who was at the proper age for such treatment. Those who are most competent to offer an opinion in this matter agree that the third and fourth years of life are the most favorable.

The errors which I made were, first, in using the cotton under the plaster. I am convinced that this was the cause of the two reluxations, as the cotton between the cast and the body permitted of too much motion, and did not hold the parts permanently in the proper relative positions. The error was, however, practically overcome by the exceptionally good sense of both the mother and the child, who were anxious and willing to try again each time as long as I thought it desirable and was able to give them encouragement.

My second error was in changing the cast too frequently and in employing anæsthesia too often; but this, I think, was

excusable, and not to be wondered at, when you consider the fact that the first two times on removing the cast I found a reluxation each time. After all, this was not nearly as great a mistake as if I had left the cast on six months the first time while the hip was not in place.

I did not make as full use of the body weight as I should have done, but at that time I did not fully comprehend how far this could be carried. I may have been a little too careful in bringing the thigh down to the normal position, but I am sure even now that this is much the better side on which to err. To wear a cast a few months longer than is absolutely necessary is no special hardship to a child, especially when the child can be about. In fact, the last few months of treatment this little patient went to school wearing the cast, and experienced no discomfort from it.

I have given this history thus in detail, knowing that these patients have been the bugbear of physicians and surgeons for centuries because of their inability to successfully treat them. Until recently these poor patients and their deeply concerned parents have been put off with a shrug of the shoulder by even the most learned members of our profession, and as most people are not satisfied with a negative answer, they have gone from place to place, and have become an easy prey to charlatans and quacks, who promise to cure all cases for a consideration paid in advance. It thus manifestly becomes our duty to report such cases with the greatest possible detail.

Here I believe we have a specimen which will convince even the most sceptical that we have obtained an almost perfect anatomical result, a joint which would always have been stable, which would have supported the weight of the body under all ordinary circumstances, and one which would permanently have insured a perfect functional result.

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ON THE USE OF THE ABDOMINAL ROUTE FOR APPROACHING RECTAL TUMORS.[1]

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It would simplify surgical work beyond the fondest hopes of the operator if exact lines of action could be defined for unifying methods of treating disease. But the more exact the study of each subject becomes, the more the operator finds that he may wisely choose between a variety of good methods, adapting one to the particular case in consideration.

With much discrimination he must approach the question of the best method of removal of cancer of the rectum. Apart from the operative technique, the subject involves principles, such, for instance, as the advisability of lessening the local irritation of the disease precinct by diverting the channel of intestinal discharge to the groin; also, of diminishing the vascularity of the pelvic viscera by ligation, in the hopes of retarding recurrence; or, third, of the now accepted principle of the very widest possible removal of cancerous growths.

The main question as to the relative value of the abdominal route in the removal of rectal tumors requires a reminder, that the word rectum involves not the part only within reach of the digital examination per anum, but that portion lying in the hollow of the sacrum, which we are all familiar with, so beautifully displayed from within the abdomen when we place a patient in Trendelenburg's position and see it almost wholly free, and covered by peritoneum in its upper part near the synchondrosis, but with less covering as it descends in the hollow of the sacrum until at the bottom of the cul-de-sac it disappears into the cellular space below. At this point there

[1] Read before the American Surgical Association, June, 1902.

remains three and a half to four inches out of sight, between peritoneum and anus.

It is the consideration of tumors of malignant nature in any portion of this tube that we are to discuss. By far the larger portion of such tumors are found near the anus, that is, roughly speaking, two-thirds do not involve the mucous membrane higher up than the peritoneal limit in their early growth, and of these there would be no difference of opinion the world over as to the wisdom of removing by the perineal route those which are found low down near the anal margin. It is with those which reach the limit of the peritoneum, or those which involve the rectum entirely above the lower cul-de-sac, that will admit of choice of method, and to remove which it has grown to be my conviction that one can best operate by the abdominal or the combined abdominal and perineal or sacral route.

The results of operation on these cases so depend on other than mechanical means employed, that statistics are of much less value to us as surgeons than the technical considerations.

In this matter I shall assume that we all have in mind that when cancer of the rectum is reported as cured by any method, it may be due less to the method than the fact that there was a big tumor all tuberous and nodular on the mucous coat, which would represent a comparatively simple affair, or a small infiltrating disseminated mass of the deeper wall, permeating the bladder or prostate, or attached to the sacrum. Therefore I shall for the moment discard statistics and appeal to principles well recognized by operators of experience.

What we all desire is a method of dealing with grave internal and high rectal growths with fullest assurance of safety to the patient, and best feeling of eradication, if such be possible. It has been my fortune to operate on many such by various methods, and to have had a growing dread of the perineal route except for the lowest tumors near the anus, until Kraske's method gave such enormous advantages of accessibility and relative bloodlessness.

In many of those, however, operated on by this method, I was impressed by the difficulty in starting the dissection by

liberating the rectum from the sacral hollow after the lower bone segments were removed. It often grows fixed and fast, and its removal in the face of hæmorrhage often gives a very "mussy" operation (if I may so speak) in spite of one's desire to make it clinically attractive.

I was also impressed by the fact that the oblique cutting upward in the pelvis with scissors necessarily makes more hæmorrhage and more jagged cuts than is desirable, and that above all, notwithstanding one's best intention, there is universally a tendency to cut off the healthy bowel nearer the disease limit than is safe. This is doubly invited by one's desire to get enough bowel to bring down to meet the anal margin, and by the fact that traction on the tumor stretches the healthy bowel, so that when cut off apparently an inch above the disease, the specimen shows only a quarter-inch of mucous membrane uninvolved. In the Kraske method one has to handle the cut end of rectum in the grasp of forceps, after removing the tumors, and considerable soiling of the wound is inevitable.

I am sure we all have had the same experience, that the rectum above the peritoneal pouch will not always pull down as we wish it would, and we are tempted to cut up behind to liberate it, and usually cut more hæmorrhoidal vessels than is good for the vitality of the bowel, when additional traction is made on it.

No one will deny that when we have carefully explored the rectal feeling of the tumors, we still have no knowledge of the intraperitoneal appearance, of the possible invasion of the peritoneal aspect of the tumor, nor of the location of the sacral lymphatics involved, nor can these be adequately appreciated until we have felt and seen them from above.

From my experience thus far in several cases of rectal tumors operated upon from above, I am impressed with the wisdom of advocating the method of Quenu, of Paris, though I have not yet gone so far as to ligate both internal iliacs preliminary to removal.

When the patient is in high Trendelenburg position and

the intestines are well out of the pelvis, the manipulation of the rectum is comparatively easy.

This will be much enhanced if a liberal median incision in the abdomen has been made, and retraction is well maintained. I have twice found a rectal obliterating carcinoma which, after excision from above, allowed union of the ends by Murphy's button in one case and by suture in another with perfect results.

The latter tumor was removed by cutting the peritoneum down either side of the rectum in the sacral hollow and across it in the cul-de-sac, thus allowing an easy cellular tissue pedicle for ligation. The lower cut end was too much buried for a button anastomosis, but after Maunsell's suggestion, four heavy silk stitches united the two ends, and their ends, left long, were brought out of the anus so as to invaginate the upper into the lower, where a few peritoneal sutures held it. A small pelvic drain tube was left for security, and the result was admirable.

One experience with an extensive growth of cancer of the lower rectum involving the base of the bladder and including prostate and vesiculæ seminales, in which I approached it by the abdominal route, emphasizes some of the advantages to such an extent that I will speak of points that are noteworthy.

The abdominal exposure being perfectly satisfactory as to position, light, retraction, etc., it is seen that several good sized lymphatic glands appear in the sacral hollow well above the growth. The upper margin of the hard tumor comes just above the peritoneal cul-de-sac. It is evident that if I excise the lower part only, I will leave some diseased lymphatics. Therefore I choose the upper part of the rectum near the brim of the pelvis, and pass two purse-string sutures of quite heavy black silk around it, piercing with the needle all coats of the bowel, and tightening these separately after cutting the bowel across, so as to invert each end by the purse-string. Then on cleansing these inverted stumps I have a perfectly clean pelvis in which to commence resection of the lower portion. Picking up the peritoneum at the side of the rectum above, a

curved blunt scissors quickly and bloodlessly cuts the peritoneum down along each side of the rectum and across in front of it. The pelvic peritoneum being loosely attached, I can now readily strip out the rectum and its vessels and lymphatics by finger dissection partly, and thus create an easy pedicle for ligation of the middle hæmorrhoidal artery and vessels. This proceeds with little loss of blood until I reach down to near the coccyx. I regard the ligation of vessels from above as an important aid. At this juncture the dissection from the under surface of the bladder seems more difficult than it would be from perineal route, though one is pleased to see how readily one peels it down from the sacrum. I then pack gauze in the pelvis, place the patient in lithotomy position on a high cushion, and finish the enucleation from below.

The inverted stumps of the bowel certainly give much comfort in operating in a clean pelvis. The purse-string stitch is the quickest method possible for closing a cut bowel end, and is one I have used in lateral anastomosis mostly, but shall always adopt it in this method for the rectum.

The question of disposing of the upper stump is one that may well appeal for solution. Whether to put it on a severe stretch and attempt to bring it into a perineal or sacral wound, or to make at once a lateral inguinal colostomy, is a question. My own argument is for the latter for the following reasons:

(1) In the combined method it settles at once all uncertainty and delay by having it brought out of an inguinal cut before the patient leaves the Trendelenburg position, thus leaving the operator free to confine his whole thought to most thorough enucleation of the cancerous rectum.

(2) It removes the anal discharges forever from the pelvis, and thus takes away one source of renewed irritation of any remaining cells of disease.

(3) If the base of the bladder proves to be involved in the complete operation and a possible leakage occurs, the dangers of mixed urinary and fæcal contamination are obviated.

(4) The results of newly established artificial ani in perineum or sacrum are such that continence of flatus and

fæces cannot usually be hoped for, even to as great an extent as in an inguinal colostomy, therefore, inasmuch as a T bandage or napkin will usually have to be worn, the inguinal has no disadvantage.

(5) When then the operator begins with the idea of turning the sigmoid colon end up into the groin permanently, he is much freer to dissect the highest part of the rectum and lower sigmoid with the hæmorrhoidal vessels, and then clean out all infected lymphatics from the pelvis, *ab initio*.

The operation as a whole is thereby simplified and abbreviated, as well as made more thorough.

(6) The great majority of cases with return of disease ultimately require artificial anus, and it should be anticipated in all by this preparation.

In conclusion, I would say that, first, operative method for cancer in different parts of the rectum must still be elective; there is no one method that applies to all. The perineal route is still the most available for very limited and very low down growths. The Kraske sacral method is available for a moderate number of growths which exhibit slight malignancy as to infiltration, and are not more than a short finger length within the anus. But the abdominal method combined with those just mentioned more nearly meets the present attitude of surgery in seeking as wide and thorough extirpation as possible for malignant growths.

Second, the artificial inguinal anus had best always be made at the time of operation, and need not be done beforehand.

Third, when the section of the rectum is made well up to the sigmoid, the ends of the severed gut should be inverted by a stout silk purse-string suture for more perfect cleanliness and handling.

A CASE OF PERFORATING GUNSHOT WOUND OF THE STOMACH AND LIVER WITH POSTERIOR THROUGH DRAINAGE AND RECOVERY.[1]

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About 6 P.M., February 3, 1902, a woman of twenty-six years, turned the point of a 22-caliber pistol towards the centre of her body and fired it in a suicidal attempt. She was soon after removed to the Buffalo General Hospital, where I saw her about 7.30 P.M. But one shot had been fired. This evidently took effect in the middle line about an inch above the tip of the sternum. Between the time of the injury and that when I saw her, she had vomited more or less fluid and bloody material. With the exception of complaint of considerable pain and the vomiting as above, her general condition was good. I at once prepared her for operation, and had the back of the body as well as the anterior surface scrubbed and sterilized.

Gas and ether were given as the anæsthetic. The area of the gunshot wound was excised by a wide elliptical incision, which was then extended downward as a straight line incision to the region of the umbilicus. The xiphoid appendix was not only perforated by the injury, but broken loose from its attachment, although not so loosely that its removal was called for. Upon opening into the upper abdomen, a large quantity of fluid and clotted blood presented, and was removed with the hand used as a scoop. Upon withdrawing the stomach, it was evident that the bullet, which had passed through the left lobe of the liver, had cut across the upper curvature a little to the pyloric side of the middle of the curved line. This opening was like a notch in the upper border, which probably had been a double

[1] Read before the American Surgical Association, June, 1902.

perforation at first, with a very slight intervening bridge, which latter was torn in the handling of the viscus. Through it the little finger could be easily passed into the stomach. The stomach seeming reasonably empty, I made no particular effort to clean it out, but at once carefully closed the opening with three rows of fine silk sutures, the first of which closed the mucosa, and the last of which took in some of the peritoneal fat, making a sort of omental graft. After replacing the stomach, it was evident that there had been considerably more hæmorrhage from the bullet track in the liver. I again removed a large amount of blood from the lesser peritoneal cavity, at first with the hand and later by sponging. Altogether at least two quarts of fluid and clotted blood were thus removed.

Of the bullet I found no further trace. Exploring backward through the gastrohepatic omentum, I could not make out any wound or injury of the pancreas; nevertheless, I made a posterior opening on the left side at the costospinal angle, and here cut down upon the point with a long pair of forceps introduced through the front and held in the left hand. Through this opening a good-sized drainage tube was drawn with the forceps, being drawn from without inward to a depth of about six inches from the skin, so that its inner end lay in the cavity of the lesser omentum in front of the pancreas.

This still left a somewhat gaping punctured wound of the liver, the hæmorrhage from which was easily checked by tamponing with a strip of gauze. This strip was left hanging out of the upper end of the abdominal wound. Before closing this wound and before making the final toilet of the peritoneum, I inserted a large gauze drain wrapped in perforated oil-silk, which was passed through the gastrohepatic omentum to such a depth that its lower end was close to the inner end of the posterior drainage tube. The abdominal wound was then closed with silkworm sutures, save for the point where the drain emerged, where secondary sutures were used.

The patient developed no unpleasant symptoms after the operation, save that on the following day her temperature was 102.5° F. She was given two enemata, each of which contained two grammes of antipyrin. She vomited no blood and raised scarcely any fluid at all. After the second day her temperature never went above 100°. The anterior drain was removed on the

third day and the gauze tampon removed from the liver on the fifth. The posterior drain was shortened on the third day and removed on the fifth. Absolutely no fluid was allowed in her stomach for four days, and nothing except water until the eighth day, she being nourished meantime by the rectum. Abdominal sutures were removed the fifteenth day. She left the hospital, March 11, 1902, in apparently perfect health. I have not subjected her to X-ray examination for the purpose of detecting the present location of the bullet, and consequently have no idea just where it may be located.

The important lesson of this case, as most impressed upon my mind, is the value of posterior drainage. Whether she would or would not have recovered without it I cannot say, but I have felt that it was a most wise and successful procedure. Other lessons conveyed by it are not confined to this alone, and would suggest themselves in any similar case with similar or even with unfortunate outcome. Not the least of them is the lack of regard paid to the location of the bullet, which still remains unknown.

COMPLICATIONS FOLLOWING GASTRO-ENTEROSTOMY.

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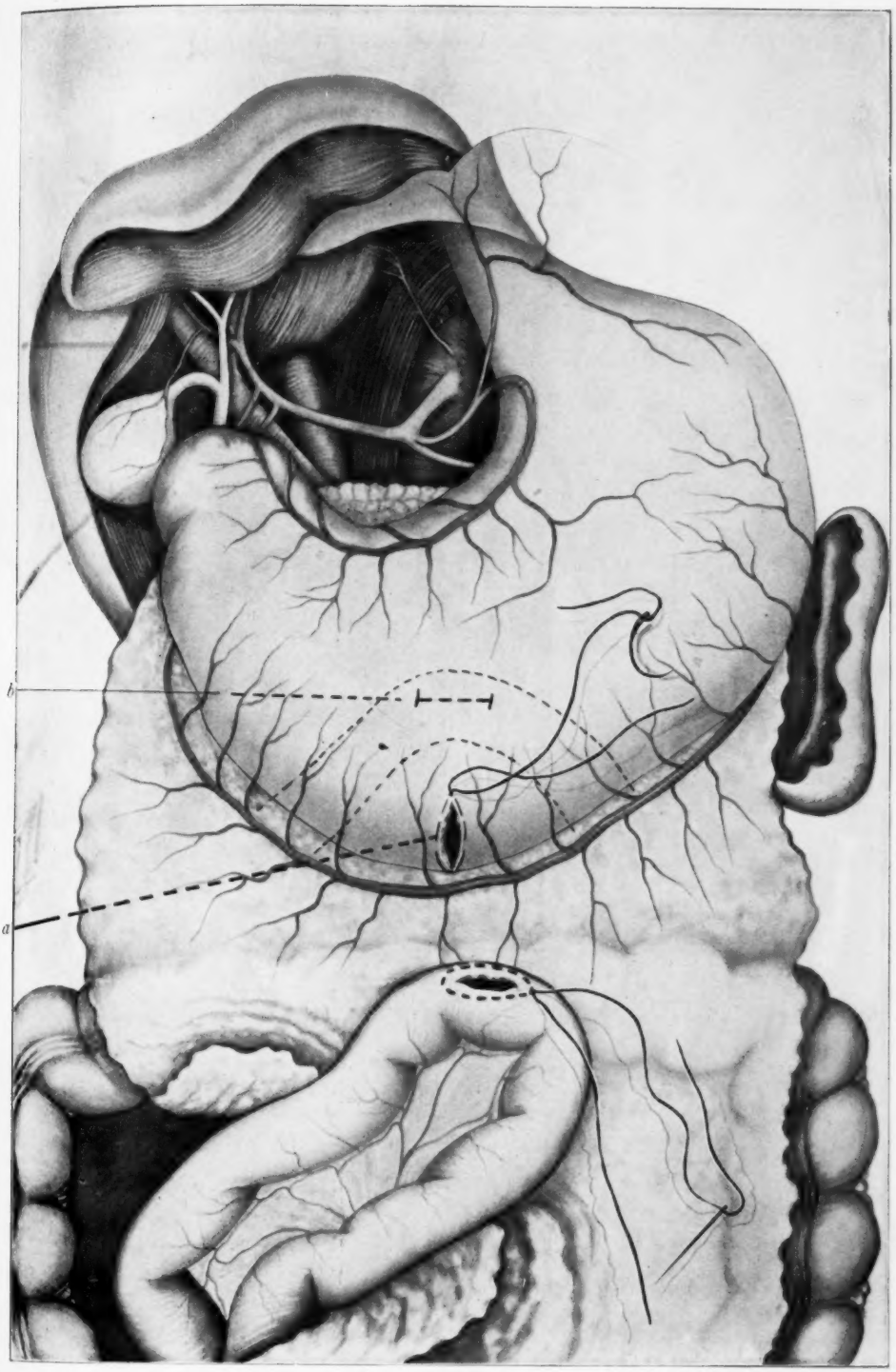
In St. Mary's Hospital, of Rochester, Minnesota, during the past ten years, ninety-eight gastro-enterostomies have been performed by my brother, Dr. Charles H. Mayo, or myself, with nine deaths, the mortality in the malignant cases being 20 per cent. and in the benign series, 6 per cent. During this time fourteen pylorectomies and partial gastrectomies have been made with two deaths, 14 per cent. Of these nine were excisions with complete closure of both the stomach and duodenal ends, communication being established by means of an independent gastrojejunostomy of the usual type. Of these one died.

For the purpose of this study these nine cases are added to the ninety-eight cases above mentioned, giving one hundred and seven gastro-enterostomies with ten deaths, an average mortality of 9 per cent. The cause of death was as follows: Exhaustion, three cases; an exhaustion in which pernicious vomiting was a prominent feature, two cases; progressive pneumonia, three cases; detachment of the anastomosed intestine from the stomach wall, two cases. The deaths from exhaustion were due to the extreme starvation which existed at the time of the operation. The patients would appear fairly well until the fourth to seventh day, when a gradual failure of the vital forces would appear and death ensue in the course of from twelve to twenty-four hours, the post-mortem showing the abdominal condition to be good. Cachectic subjects bear rectal feeding badly, and early giving of nourishment by the stomach should be practised when possible.

The two cases in which regurgitant vomiting hastened the fatal ending were among the early operations, in which the intestine was joined to the anterior wall of the stomach, halfway between the greater and lesser curvatures, causing an intragastric pouch to form which contributed to the unfortunate complication. In neither one could it be said that the vomiting itself caused death, but in the feeble condition of the patients it certainly was a factor. It will be noted that nearly one-third of the total death-rate was due to bronchopneumonia.

There have been many explanations as to the frequency of lung complications following operations upon the stomach. It was thought to occur as a result of general anæsthesia, but experience has shown that it is relatively as frequent after the use of a local anæsthetic. The situation of the incision in the epigastrium, preventing coughing and expectoration, is thought to be an element in causation, yet similar incisions in the gall-bladder region have no such effect. The latest theory is that some of the venous blood returning from the stomach does not pass through the portal vein, and in this way infected emboli are carried directly into the circulation and pass at once to the lungs. In two of the three cases a chronic bronchial cough was present at the time of operation, and the patients were in bad general condition. In one case material was aspirated through the trachea from the œsophagus, causing an aspiration pneumonia. It is difficult, by means of the stomach-tube, to thoroughly cleanse and empty the greatly dilated stomach in debilitated subjects. In this case, on elevating the stomach out of the abdominal incision, some of the fluid contents gravitated into the œsophagus. This should be avoided in these cases by elevation of the head and thorax at this time. The recumbent posture has also an evil influence on some cases, and we now encourage the old and feeble to sit up early. It is evident that there is as yet no entirely adequate explanation for the production of the pulmonary complication. There are probably several contributing causes in most cases.

In the two cases in which the anastomosed intestine was detached, causing death from leakage, one took place on the



Showing proper and improper locations of opening. *a*, Proper position, leaving no pouch; *b*, usual position, forming intragastric pouch.

seventh day after gastro-enterostomy for malignant pyloric obstruction. There was a small amount of free fluid present in the abdomen at the time of operation which would usually contraindicate a plastic procedure such as gastro-enterostomy. In the second case, detachment on the ninth day followed an epileptic seizure. This was in a patient with benign obstruction, who had up to that time done unusually well. He had suffered from epilepsy for years, and the aura began in the epigastric region. In a violent contraction of the stomach such a detachment might easily take place. Chlumsky's experiments on presumably healthy animals went to show that after five days the union was perfect. That this is not true as to diseased states in the human subject is shown by these two cases.

Of the ninety-seven cases which recovered from the operation, five benign cases came to secondary operation on account of changes at the anastomotic orifice.

The most important feature in the mechanics of the anastomosis is that the union shall be at the inferior border of the stomach, close to the greater curvature and at the bottom of the stomach pouch, giving a funnel shape. Properly placed, the anastomotic opening should have its inferior border at the bottom of the stomach, and as to whether the opening shall extend from this point upward anteriorly or posteriorly is really of little moment—see plate (Fig. 1). The anterior operation has usually been placed relatively higher than the posterior to avoid the blood-vessels, causing an intragastric pouch to form, which has been one source of pernicious vomiting. The posterior operation for technical reasons (easier exposure) is usually placed nearer the greater curvature. The union in the one hundred and seven cases under discussion was made to the anterior wall of the stomach eighty-three times and twenty-four times to the posterior wall, with equally good results, so that location of the opening on the anterior or posterior wall cannot of itself be essential.

In the experience of the writer, the one operation is as easy as the other. For thin subjects with a long mesocolon we prefer the posterior method. If the mesentery is short or

contains much fat, or if the vascular loop, from the superior mesenteric artery, which supplies the transverse colon, is small, bringing the opening in the posterior layer of the gastrocolic omentum in close proximity to it, the anterior operation is preferred. After posterior gastro-enterostomy the torn edges of the mesentery are sutured to the posterior wall of the stomach as advised by Willy Meyer, to prevent downward displacement and interference with the loop as happened to Meyer, Czerny, Körte, and others. These sutures are introduced in such a manner as to provide a short flap of the mesenteric margin, which drops over the anastomotic opening, furnishing further protection. After the anterior operation, the edges of the omentum are caught each side of the anastomosis and sutured to each other and to the stomach wall one inch above the opening. The edges are united to each other downward for three inches, forming an apron over the anastomosis, yet having no connection with it; and as this is done with a fine catgut suture, the adhesion is not of itself permanent. This makes the omentum available if leakage occurs, and in time the omentum returns to its normal situation if no accident happens, as I have had an opportunity to verify later.

This may seem an unnecessary precaution, but when it is considered that 20 per cent. of the deaths were due to separation of the bowel from the stomach at a time (ninth and tenth day) when neither suture nor button would furnish adequate support, it is not unreasonable. Both of the fatal cases were anterior operations, and it was the superior edge of the union which gave way as shown by post-mortem. The inferior margin, being protected by the origin of the omentum, was exceedingly firm. We have used the Murphy button in all of our cases, excepting one case in which the suture and the Robson bone bobbin were employed to meet a special indication.

CASE I.—*Gastro-enterostomy; Reoperation Four Years later for Secondary Ulceration; Recovery.*—Mrs. H. H. O., aged thirty-eight years, Scandinavian, mother of three children, housewife, was admitted to St. Mary's Hospital, May, 1899, with the following history: Has had symptoms of ulceration of the stomach

for several years; for the past two years the trouble has been constant. The vomiting, which at first was immediately after taking food, is now delayed a number of hours, and the larger part of the nourishment is eventually rejected. She eats as small an amount as possible, and is confined entirely to liquid food. Has lost thirty-five pounds or more in weight. Personal and family history good.

Physical Examination.—Emaciation marked, skin dry, pulse and temperature normal. Upper abdominal region distended. On inspection, peristaltic waves can be seen passing from left to right. Splashing phenomenon easily developed. On air distention, the greater curvature of the stomach found to lie on a line with the crest of the ilium. Test meal shows free acid. Diagnosis, benign pyloric obstruction due to the cicatrization of an ulcer.

Operation.—Irregular cicatrix involving pylorus, three-fourths of an inch in diameter and one and one-fourth inches in length. Anterior gastro-enterostomy. Recovery uneventful. For three years remained in splendid health, gaining over forty pounds in weight. April 1, 1902, readmitted on account of return of previous symptoms of obstruction, which had begun suddenly three months before, and were supposed to be due to an attack of appendicitis. Patient had lost much flesh and was on a liquid diet. The trouble was evidently due to some interference with the outlet of the stomach.

Operation, April 2, 1902.—A mass of adhesions was encountered to the right of the median line, due to an ulcer of the stomach just above the anastomotic orifice, and involving the opening above and upon the right side.

Perforation had occurred and the adhesion to the abdominal wall had prevented leakage. The transverse colon was closely adherent and much reduced in calibre where it passed under the anastomosis. The entire ulcerated area was excised, leaving a large opening with only one-fourth of the gastro-intestinal union on the left side intact. This defect was sutured, and the gastro-enterostomy completed by suture over a Robson bone bobbin, the large plastic being protected by the omentum. The Murphy button was found in the stomach somewhat corroded but in fairly workable condition. Pylorus completely obstructed. The stomach was drawn down into a funnel at the site of the anastomosis,

and I am under the impression that at the time of the sudden symptoms the button became impacted and caused the ulceration. This is surmise, as it was found in the fundus of the stomach.

Each button should be carefully inspected before it is used. We have found on an average nearly 20 per cent. of buttons of imperfect workmanship and dangerous.

If the stomach wall is thick, the muscular and peritoneal coats should be incised before the suture is placed, and the suture should grasp only a small portion of these structures, otherwise the button may be held in position unduly long. In many cases in which the button passes, vomiting, with symptoms of obstruction, may appear in the second or third week while it is in transit. Gastric lavage and rectal feeding for a day or two cause these symptoms to subside.

The suture operation for gastro-enterostomy is undoubtedly just as good as the button, and, so far as can be judged, the results are about the same. Among the men of great experience, Kocher uses the suture and the posterior method, Czerny the button and the posterior, Mikulicz prefers the suture in benign cases and the button in malignant cases, and uses the anterior operation altogether. He finds that an entero-anastomosis is necessary in the suture operation to prevent pernicious vomiting, but does not find it necessary with the button, which tends to prevent angulation while *in situ*, and this is during the dangerous period. Robson's bone bobbin acts in a similar manner. Kelling found that with the suture a ring of mucous membrane projected into the stomach, diminishing the caliber of the opening. The opening is less perfect with the suture, and entero-anastomosis is more often necessary to prevent pernicious vomiting. These advantages in favor of the button are counterbalanced by its tendency to drop into the stomach and remain there (Case I). This usually does no harm, and in malignant disease, at least, does not counterbalance the advantage.

In our earlier experience with gastro-enterostomy, the operation was performed entirely for pyloric obstruction, and

in but two cases (IV and V) did any secondary complication develop with regard to the orifice, excepting its occasional occlusion by an advancing malignant growth. Two cases of malignant obstruction, examined post-mortem after the lapse of some months, showed no marked contraction of the opening. For non-malignant pyloric obstruction, cases in the best of health, all the way from the present time up to eight years after the operation, demonstrate the permanence of the artificial opening. In two benign cases dying of other causes, six months and three years respectively after the operation, and representing an anterior and posterior location of opening, there was no contraction. In a case reported by Cordier after six and one-half years, death from other cause allowed of post-mortem, and there was no contraction of the anastomotic opening found. Without going into detail, it may be said that if permanent obstruction at the pylorus exists, no marked contraction of a properly formed gastro-enterostomy may be feared, unless by accident (Case V).

About three years ago, gastro-enterostomy for the relief of ulcer was first performed at St. Mary's Hospital, and since that time with increasing frequency, about twenty-five cases in all. In a majority of these cases the pylorus was not mechanically obstructed, although the ulcer was usually in the pyloric region, and in some cases ultimate cicatrization might be expected to materially reduce the caliber of the normal opening. In three of these cases, angulation and obstruction at the site of the anastomosis occurred at a later date (Cases II, III, and IV). In these cases, secondary exploration revealed a marked contraction of the orifice, reducing its size to that of a lead-pencil or less, although in no case was obliteration complete. There was found an angulation of the jejunum at the attachment, causing a spur which accounted for the symptoms. The reduction, so far as the stomach was concerned, was of little moment, but a contraction involving one-third of the lumen of the small bowel was serious and caused valve formation.

CASE II.—*Entero-anastomosis Thirteen Months after Gastro-enterostomy; Recovery.*—Miss G. C., aged twenty-one years, American, seamstress, was admitted to St. Mary's Hospital, May 9, 1900, with a typical history of ulcer, which had existed for more than a year and defied ordinary methods of treatment. Hæmatemesis had been a prominent feature, and on two occasions so copious as to threaten life; had lost twenty-five pounds in weight. Family and personal history otherwise good.

Physical Examination.—Marked anæmia from the hæmorrhages, organs other than stomach normal. A painful point the size of a silver dollar in the epigastrium. Stomach contents not examined, it being feared that the necessary manipulation might cause a return of the hæmorrhage. May 10, anterior gastro-jejunostomy, Murphy button. Stomach small, pylorus unobstructed, ulceration on lesser curvature of irregular outline, an inch in diameter, shown by induration, and covered by perigastric adhesions. Button passed during third week. Discharged in the fourth week. Rapid gain in weight and complete disappearance of symptoms for four months. Then began to have attacks of burning pain in the stomach. These became more frequent, and occasionally a little bile-stained fluid would be vomited. This was not attended by great loss of weight or strength, but was very annoying.

In June, 1901, exploration revealed the fact that the gastro-intestinal fistula had contracted to the size of a lead-pencil or smaller; this produced a kink of the jejunum at the site of the anastomosis. Entero-anastomosis between the afferent and efferent limbs of the jejunum promptly relieved the symptoms. Patient now in good health.

CASE III.—*Secondary Gastro-enterostomy and Entero-anastomosis Twenty Days after Primary Gastro-enterostomy; Recovery.*—P. D., aged thirty years, German, farmer, was admitted to St. Mary's Hospital, March 21, 1901. History of chronic ulcer of the stomach extending over six years, which had obstinately resisted treatment. During most of this time he had been incapacitated for labor. To relieve the pain, semi-starvation had been practised. Personal and family history immaterial.

Physical Examination.—An emaciated man of sallow complexion, dry and leathery skin. Heart, lungs, kidneys, etc., in normal condition. Tenderness just above umbilicus. Stomach

moderately dilated, free acid and some retardation of food. March 22, anterior gastro-jejunostomy, Murphy button. Ulcer on posterior wall and adherent to pancreas. The latter enlarged and thickened, no mechanical obstruction at the pylorus. For two weeks patient did very well, then began to vomit biliary and pancreatic secretions; button passed on sixteenth day. Vomiting at first intermittent, and no food returned unless given during the period of active regurgitation. Twenty days after the primary operation, the abdomen was reopened. The anastomotic opening had contracted to the size of a lead-pencil and spur formation of the small bowel was marked. As it seemed improbable that the ulcer should have permanently cicatrized in this short space of time, anterior gastrojejunostomy was again performed with the Murphy button, and an entero-anastomosis short circuiting the biliary and pancreatic secretions below both openings was made by means of a small button. Discharged in three weeks. Rapid gain in weight and strength. He is now in good health and able to perform manual labor.

Entero-anastomosis promptly relieved the condition in these two cases. In the third, for reasons referred to later, death ensued. Contraction of the anastomotic opening is to be expected if the pylorus is unobstructed; but that it does not always produce symptoms was shown in a fourth case, in which gastro-enterostomy for an active ulcer had promptly relieved a most serious condition. At a secondary operation for a pelvic tumor, some months later, great contraction of the orifice was found, but without unpleasant symptoms arising therefrom. The writer was under the impression, in Case V, after the first entero-anastomosis failed to relieve, that perhaps the kinking caused the bile to accumulate in the duodenum, and that the regurgitation was through the pylorus. For this reason the pylorus was excised with complete closure of both the duodenum and stomach ends; yet this failed to check the biliary vomiting, showing conclusively that it was the spur at the opening alone which was responsible for the trouble. Von Eiselberg reports cases in which he has closed the pylorus by a circular purse-string suture, evidently with the same idea which proved fallacious in this case.

The question of the reduction of the opening taking place in the greatly dilated stomach *pari passu* with the contraction of the stomach itself has been pretty well settled by Robson, Körte, and others. The stagnation is promptly relieved, but the hyperdilated stomach does not contract much, and the lesser degrees of dilatation which regain normal size do not materially affect the anastomotic opening. Carle and Fantino have shown conclusively that small quantities of bile are to be found in the stomach after gastro-enterostomy, and that it does not lead to trouble. Ferrier and others have connected the gall-bladder directly with the stomach without interfering with digestion. The pancreatic juice cannot be the cause, as Stendel has experimentally divided the jejunum, fastening the open end to the stomach and closing the duodenum completely at the severed point, causing all the biliary and pancreatic secretions to pass through the stomach, yet no harm resulted. This was also true of Moynahan's case in which this procedure was carried out on the human subject. McGraw believes that the views of Kelling are correct, and that it is the distention of the duodenum which is responsible for the evil effects. The fact remains that entero-anastomosis between the proximal and distal loops of the intestine, short circuiting these secretions, relieves the condition. The possibility of secondary spur formation following gastro-enterostomy for ulcer in which the pylorus is open must be borne in mind, and, if possible, excision of the ulcer is to be preferred. This the writer has been able to do three times for gastric ulcer and once for duodenal. It has been advocated, especially in this country by Robert Weir, to perform an entero-anastomosis in all cases of gastro-enterostomy at the primary operation. This is certainly logical in the cases under consideration in which the pylorus is open.

We have preferred the simple operation of entero-anastomosis rather than the more elaborate methods of Roux and others, and in only one case, that a posterior operation, has relief failed to follow. This was due to the fact that the jejunum was anastomosed so close to its origin as to prevent proper drainage from the proximal side through the interintestinal fistula.

CASE IV.—*Gastro-enterostomy followed by Entero-anastomosis, Pylorectomy, Entero-anastomosis; Roux's Operation; Death.*—Mrs. J. M., aged forty-two, one child, Scandinavian, housewife, was admitted to St. Mary's Hospital on June 19, 1901. Typical history of chronic ulcer of the stomach. For three years symptoms nearly constant, vomiting, pain, loss of weight and strength, confined to the bed for several weeks previous to admission to the hospital, and for some months has required opiates more or less constantly. Personal and family history good.

Physical Examination.— Emaciation marked. Painful area in epigastrium. Stomach not increased in size. Free acid. June 20, posterior gastrojejunostomy, Murphy button. Attachment to jejunum about six inches from its origin. Stomach not dilated, pylorus open, location of ulcer could not be accurately determined on account of perigastric adhesions. Gall-bladder contained one stone evidently slumbering, as there were no evidences of disease about this viscus. Stone removed and gall-bladder drained through stab wound on the right side. Patient discharged in good condition on the twentieth day. July 24, 1901, readmitted; one week before had commenced to have attacks of burning pain in the stomach, and since had regurgitated a little bile-stained fluid at frequent intervals. Gastric lavage failed to relieve the symptoms.

June 25, entero-anastomosis. Operation difficult and unsatisfactory on account of the short length of the afferent intestine, and when completed, the interintestinal fistula was on a level with the gastric opening and only about two inches from it. Gastro-enterostomy contracted to less than the tip of the little finger and angulation of the attached jejunum.

Condition improved rapidly and for a time was apparently relieved. October 12 readmitted, with all of the old symptoms in an aggravated form. Under the impression that the biliary and pancreatic secretions entered the stomach through the pylorus, on October 14 pylorectomy was performed, and the duodenum and stomach completely closed by a purse-string suture. No relief. October 18 a second button entero-anastomosis was made. This was a mistake, as between the previous entero-anastomosis and the origin of the jejunum there was less than three inches. Some relief was experienced for a few days. October 30 the previous symptoms had returned with increased sever-

ity, and as the patient was becoming exhausted, as a final resort the operation of Roux was performed. The adhesions from the previous operations rendered this extremely difficult. The jejunum was divided as closely as possible to the last entero-anastomosis and the distal end turned in by a purse-string suture. Less than an inch of jejunum projected on the proximal side. A Murphy button was inserted and with some difficulty secured in position. A loop of bowel sixteen inches below was attached laterally. Patient returned to bed in bad condition and died thirty-six hours later. A melancholy ending after such courage and endurance.

This at once brings up the question as to how long a loop of jejunum should be made above the point of anastomosis. Robson says that for the anterior method twelve inches is about right and for the posterior somewhat less. Mikulicz says that fifteen cubic centimetres is the necessary amount for the posterior operation and fifty cubic centimetres for the anterior operation. We have averaged about fourteen inches for the anterior method, and since the unfortunate termination of the case referred to, not less than ten inches for the posterior. Meyer reports a case in which fifteen centimetres proved to be too short for convenience at a secondary operation. Peterson, from the Heidelberg clinic, has studied the anatomy of gastro-enterostomy, and calls attention to the fact that the origin of the jejunum is at a higher level than the site of the anastomosis in the posterior operation. This would place the proximal portion of the jejunum above the opening, and he believes that the absence of pernicious vomiting in the cases in Czerny's clinic is due to this cause, although it is evident that the location of the opening on the posterior wall of the stomach must in these cases have been at an inferior point, and it is probable that the advantage may lie in this feature of the operation. If the obstruction at the pylorus be permanent, there can be no objection to the short length of jejunum above, but if an open pylorus threatens contraction and spur formation, this may prove unfortunate. The last complication to be briefly referred to is the possibility of the small bowel passing through the loop of intestine above

the anastomosis. This danger is much greater with the anterior than the posterior method. Case V so well illustrates this condition as to need no further comment.

CASE V.—*Anterior Gastro-enterostomy; Secondary Operation for the Relief of a Twist at the Anastomotic Opening caused by Small Intestine passing through the Loop.*—R. N. S., aged forty-one years, American, barber, was admitted to St. Mary's Hospital, January 1, 1901, with the following history. For several years has suffered from attacks of burning pain in the epigastric region lasting for a few minutes at a time, but recurring at intervals of several hours. Much worse when at work at his trade. These " cramps " would last in this way for several weeks at a time, after which there would be an interval of weeks or months of good health. For several months has had more or less stomach trouble, and occasionally vomited up the contents of the stomach. The distress has caused him to eat sparingly, and he has lost twenty-five pounds in weight. He had an attack of appendicitis with an abscess some years ago; the latter had been incised, but the appendix was not removed. He has had a right inguinal hernia for many years.

Examination.—A spare man, six feet and one inch in height, emaciation noticeable. With the exception of the stomach, no feature of interest. Painful point in epigastrium. Free acid, greater curvature of stomach three inches below the umbilicus.

Diagnosis.—Pyloric obstruction from ulcer. January 2, anterior gastrojejunostomy, Murphy button, appendectomy, and Bassini operation on hernia. An ulcer existed at the pylorus extending to the lesser curvature, irregular contour, size of last phalanx of forefinger. Evidently partially cicatrized and obstructing pylorus. Fourteenth day symptoms of intestinal obstruction lasting forty-eight hours. Condition relieved by gastric lavage and rectal feeding. Button passed on the sixteenth day, evidently cause of symptoms. Discharged January 18; gained rapidly in weight and strength. For a year remained in good health, although complained that if he stood erect he had a " drawing feeling" in his stomach. From this time to May 14, 1902, when he was readmitted to the hospital, he had slowly developed all of the former symptoms of obstruction at the outlet of the stomach, and had a constant pain in the abdomen centring below the umbilicus.

May 15 abdomen opened. Gastrojejunal orifice nearly obliterated and stretched to an inch in length. Jejunum twisted at the site of anastomosis one-half turn from the left to the right. Somewhat more than one-half of the small intestine had passed through the loop of jejunum between the origin of the jejunum and the attachment to the stomach. The point of entrance was on the right side beneath the transverse colon. The traction weight of the intestines upon the mesentery at the inferior margin of the loop had caused the volvulus. The mesentery at this point was much thickened. The intestines were replaced. The gastrojejunal fistula divided and the opening into the stomach closed. The opening into the jejunum was enclosed by a purse-string suture, and the half of a Murphy button was introduced and a posterior gastrojejunostomy made. The pyloric stricture was nearly complete, the ulcer evidently cicatrized. It is probable that the part of jejunum immediately below the anastomosis passed through the loop first, producing the twist which was so prominent a feature on opening the abdomen. As to when this happened, it is hard to tell, probably not for some months after the operation. When the process once began, it might be expected to continue until such an amount of intestine travelled over the loop as to pull the mesentery taut, the symptoms increasing as the condition gradually developed. It is possible that at the time the juncture was effected, a slight twist might have occurred.

REPORT OF FIVE CASES OF LAPAROTOMY FOR INTESTINAL OBSTRUCTION.

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THE importance of early exploration and early interference in abdominal disturbances in general, and in intestinal obstruction in particular, is too apparent to require any additional emphasis. These cases were taken from a number operated upon during the past fifteen months and reported here because of certain features of interest they possessed.

Although devices and clamps of one variety or another will always occupy a place in surgery, the tendency is, however, in the direction of the needle and thread as the true surgical method. When we are able to reach conveniently the seat of resection or anastomosis and the patient is not *in extremis*, the time saved does not compensate for the step backward in resorting to a device.

The opening and closing of the abdomen, the necessary examinations, together with the resection and anastomosis, required but fifty minutes in the first case.

What seems to be more necessary than either devices or clamps is a little more practice with a needle and thread, and an understanding of not one, but several methods of resection; and then, in all but a very limited number of cases, the operator will be able to get the most satisfactory results.

Case II is of interest as illustrating the slight degree of intussusception and the peculiar symptomatology of the case.

It is important to note the influence of the simplest nourishment upon the pains. Any food would provoke and maintain

peristalsis until disposed of. In this we have a practical hint that may be applied in the diagnosis and treatment of other intestinal disturbances. The pains followed the ingestion of food with such uniformity that the child abstained from food almost altogether until reduced to emaciation.

Halstead, of Chicago, ANNALS OF SURGERY, Vol. XXXV, referring to the statistics of Kelynack in which Meckel's diverticulum was present eighteen times in 1446 post-mortems. In 3400 examinations in St. Bartholomew's Hospital there were twenty-seven in which Meckel's diverticulum was found, making one in every 126 bodies. The same writer reviews Leichterstern's cases of intestinal obstruction numbering 1134. Thirty-nine per cent. were due to intussusception, 9 per cent. to bands and adhesions, and 6 per cent. to diverticula.

Of another series of cases collected by Haven, Duchanssoy and Brinton, making in all 991, in about 6 per cent. the obstruction was due to the Meckel's diverticulum.

Halstead believes that Meckel's diverticulum probably occupies a place next to intussusception as a cause of intestinal obstruction.

CASE I.—*Multiple Intestinal Strictures of Tubercular Origin; Intestinal Resection and Ileocolostomy; Recovery from Operation; Death later from General Tuberculosis.*—Mr. C., aged thirty-six years; occupation, farmer. Referred to me by Dr. S. T. Botts, of Glasgow. Family history revealed tuberculosis upon the maternal side. Personal history prior to present trouble, negative.

History of present trouble. About eighteen months previously the patient swallowed a pin. According to his version, it was arrested for a short time in the œsophagus. After a lapse of a number of days there appeared a pain in the region of the umbilicus. This persisted with varying degrees of intensity throughout the whole eighteen months. At times it amounted to no more than a sense of discomfort, and on several occasions, during part of the eighteen months, the pain was so excruciating as to require large doses of morphine. He referred to his trouble as being obstructive in character. He insisted that he could feel the arrest of the intestinal content at one point, and at a certain

time feel the obstruction relieving itself. This relief was usually hastened by the ingestion of certain digestive ferments.

In the last six months he lost some weight, but otherwise appeared healthy, and always led an active life. Examination of the abdomen was practically negative. Neither inspection, percussion, nor palpation yielded any information.

The patient was accompanied by his physician, who desired to be present at the operation, but was unable to remain in the city for any length of time, and, therefore, the usual opportunity for the observance of the case was lacking. The day before the operation as well as the day of the operation, his temperature ranged between 99¾° and 100° F.

An exploratory incision was proposed, reserving the right to deal with the condition as thought proper.

Upon opening the abdomen, the cæcum was represented by a mass almost twice the natural size and distinctly inflammatory in its appearance. Upon manipulation, the mass was rather dense and considerably thickened. The entire mass was firmly bound down, but no tubercles were apparent. Upon examination of the small intestine, two strictures were found at about the middle of the ileum. These occupied three-quarters of an inch of the intestine, and were located about six inches apart. These strictures represented an almost complete occlusion of the intestinal lumen.

To the touch it was apparent that quite a thickening of the intestinal wall had occurred, and upon inspection there appeared what seemed to be a few miliary tubercles close to the mesenteric border of the intestine. Careful inspection failed to disclose tubercles in any other portion of the abdominal cavity. From this, three points of obstruction were apparent,—the two strictures just named and the obstruction in the cæcal region. Careful examination of the cæcal mass determined the inadvisability of its removal. To overcome the cæcal obstruction, an ileocolostomy was performed by making a communication between the lower portion of the ileum and the colon just above the sigmoid flexure. The communication measured four inches in length. In making this communication, three successive rows of suture were employed. The condition of the patient being still favorable, the other strictures were overcome by means of a resection, performed after the method of Woelfler. This included both strictures, the

amount of intestinal tract removed being about eight inches. The time consumed in this operation was fifty minutes. The intestinal symptoms were relieved at once. The wound healed solidly excepting for a distance of about one inch at its lowest point. Although no distinct abscess occurred, the process was granular and of a glazed appearance, and yielded very stubbornly to epidermization.

The patient left the infirmary at the end of a month.

Although the obstructive symptoms had entirely disappeared, a slight fever persisted, and he failed to make any progress in regaining his strength. Three months later he died of a general tuberculosis. Post-mortem examination (for which I am indebted to Dr. Botts) revealed general tuberculosis of the abdominal cavity. The result of the intestinal operations was all that could be desired. Microscopic examinations of the resected specimen verified the tubercular nature of the trouble.

CASE II.—*Intussusception, Operation, Suture of Intestine; Recovery.*—Louis, aged six years. Referred to me by Dr. A. F. Beuren. Child presented the following history. Family history good. He had never been sick before. Was taken ill about a month previous. The onset of present illness was rather sudden, following soon after eating a large amount of dried fruit. Patient began to complain of severe abdominal pains, which at first were constant, but after a lapse of a few days became intermittent in character. He had been treated for weeks with various drugs, including opiates, bismuth, digestive ferments, and vermifuges.

When seen by me his condition was as follows: Extreme emaciation, temperature and pulse normal, no abdominal pain upon palpation, nor any tumor discernible. Pains occurring at varying intervals from half to several hours, and always precipitated and aggravated by taking any form of nourishment. Tendency to extreme constipation, but no distinct obstruction.

An exploratory incision revealed an inflammatory condition about the ileocæcal valve, which upon closer examination consisted of a considerably thickened ileum that was protruding into the cæcum for the extent of one inch.

The intussusception was reduced, the ileum incised, and the incision in the intestine closed by means of Lembert sutures. The child made an uninterrupted recovery, all symptoms disappearing.

CASE III.—*Obstruction from Meckel's Diverticulum.*—H. K., aged seventeen years. Referred to me by Dr. L. J. Herget. Family history good. When seen was suffering from acute appendicitis of forty-eight hours' duration. Operation was proposed and carried out. The appendix was found gangrenous but not ruptured. Its removal was carefully effected, and the stump buried by means of a double row of sutures. The patient made a rapid recovery. During the operative procedure, the cavity, as usual in such cases, was carefully protected, so that practically only the cæcum was exposed to manipulation. For this reason the presence of a Meckel's diverticulum was overlooked.

About a month after leaving the infirmary he secured an entrance to the pantry and devoured a number of apples. This exploit was rapidly followed with colicky pains, that became so severe that his family doctor was sent for, who administered opiates, with but temporary relief. When the effect of the opiates wore away, the pain reappeared in its former severity. When seen by me he was suffering from severe abdominal pains, which were referred to a point on a level with the umbilicus and almost one inch to the right. Temperature, 99° F.; pulse, 100; slight distention, but no tumor.

The patient was removed to the infirmary, and on the following morning, with the assistance of Dr. W. C. Dugan, an exploratory operation was carried out. At the time of the operation the temperature reached 100° F.; pulse, 112; pains still severe and considerable distention. Upon opening the abdomen, a few ounces of peritoneal fluid escaped, and distended loops of intestine bulged through the opening.

In following out the distended coil of intestine, an acute angulation was encountered that was occasioned by the adhesion of the Meckel's diverticulum to another loop of intestine.

The diverticulum was short and stubby in character, measuring about one inch in length and half an inch in diameter. The process was obliterated by folding it parallel with the bowel and then burying it with a row of sutures. The abdomen was closed. For two days following the operation, marked evidences of peritonitis persisted. On the third day the intestinal functions were re-established, and with this all evidences of peritoneal disturbances disappeared.

CASE IV.—*Intussusception due to a Lumbricoid.*—B., aged

five years. Family history good. Personal history good. Six days previous he suffered for two days from a disturbance that was diagnosed by his attending physician, Dr. Tompkins Botts, as an intestinal obstruction due to an intussusception. This attack lasted for two days. The child when seen by me had been suffering for about eight hours from its second attack. Its condition was as follows: Temperature, 99° F.; pulse, 120. Abdominal examination negative in character. The patient was in extreme pain, rolling and tossing about and vomiting a dark-colored fluid. The diagnosis of an intestinal obstruction was made and an immediate operation urged. The parents were wholly unprepared for such an advice, and insisted upon a delay, hoping that the next few hours might bring an improvement. Instead of this, the child grew steadily worse, the pains became more severe, the vomiting more frequent and stercoraceous in character. The pulse became rapid and feeble.

At midnight the parents consented to an operation, which was carried out as rapidly and carefully as the crude and imperfect conditions permitted. Dr. S. T. Botts administered the anæsthetic, and his son, Dr. Tompkins Botts, acted as my only assistant.

The abdomen was opened, and multiple intussusceptions revealed. Two of the intussusceptions represented a section of three or four inches of intestine. A third consisted of ten inches of intestine that had become invaginated. All these involved the ileum. The invaginations were readily reduced. Upon reducing the chief of these, a good-sized *lumbricoid* was felt and seen through the intestinal wall. The intestine was incised and the parasite removed. The intestinal opening was closed by means of Lembert suture. The abdomen closed. For the next six hours the relief from pain was complete, and the nausea was only that which ordinarily follows the administration of an anæsthetic. Towards the middle of the following day there was some return of pain; the vomiting increased, and at the close of the first day symptoms returned similar to those prior to the operation, but not of the same severity. The child died at the beginning of the third day.

Case V.—*Obstruction due possibly to a Hernia into a Retroperitoneal Fossa.*—C. K., aged four years. Referred to me

by Dr. A. F. Beuren. Family history good. Personal history good.

The child had been perfectly well until five days previous. Onset sudden, consisting of severe abdominal pains. These were paroxysmal in character and varying in intensity. The occasional vomiting was of a clear mucus. Considerable tenesmus and watery evacuations mixed with a greenish coagula and a clear tenacious mucus, formed in character and not unlike a very thin tapeworm.

The abdominal inspection was negative in character. Palpation likewise yielded nothing. No tumor was visible, and there were no especial points of tenderness. Upon opening the abdomen, distended loops of intestines presented themselves. After a careful search about the cavity, the seat of the disturbance was located upon the right side of the cæcal region. The intestines in this region were crowded together but not adherent, although very much congested. After some manipulation, the cæcum was brought into view.

The age and condition of the child did not permit of as careful an investigation as one would desire. There was no invagination, nor could any volvulus be detected. No bands were observed. The cæcum, the beginning of the colon, and the lower end of the ileum seemed to be crowded upward and backward. With some traction the entire mass was brought into view. The appendix was in striking contrast with its surroundings, resembling a wax taper more than a vermiform appendix. The cæcum was slightly congested. The intestine was opened for a more careful examination of the condition with negative results. The appendix was removed and the stump buried by means of a row of sutures. By this time an hour and a quarter had elapsed, and the condition of the patient was such as to make all further efforts unadvisable.

The precise nature of the obstruction was not determined, but in the absence of any bands, invaginations, or volvuli, which is reasonably certain did not exist, it was suspected that in a child of this age the obstruction was due to a hernia into one of the retroperitoneal fossæ.

The patient was removed *in extremis,* and for a time its reaction was doubtful. All symptoms disappeared, however, and the recovery was uninterrupted.

ON A CASE OF SPLENECTOMY FOR LEUKÆMIC ENLARGEMENT.

By THEODORE A. McGRAW, M.D.,

OF DETROIT, MICHIGAN,

PROFESSOR OF SURGERY IN THE DETROIT MEDICAL COLLEGE.

Encouraged by Dr. Richardson's case of a leukæmic spleen, I ventured last summer to operate on a similar case in the person of a child eight years of age. I was not fortunate in the result, but the case, nevertheless, presents some interesting features which make its publication seem desirable.

J. I., aged eight years, was brought to me by his father on June 3, 1901. I could not get a very satisfactory history of his case, but as far as obtained it was as follows: He had begun to show symptoms of ill health nearly two years before I saw him. He had suffered but little pain, but had had frequent attacks of chills and fever, for which he had taken large doses of quinine. He still had these paroxysms at intervals of about two weeks' duration. Twenty months ago it was noticed that his abdomen was large and swollen. This swelling had since then constantly increased, until now it was the most marked feature of his anatomy.

Although he was pale and debilitated, his mucous membranes, nevertheless, retained their pink hue and showed none of that pallor characteristic of some kinds of leukæmia. His appetite had during the whole period been good, but the distress from tension after eating prevented him from fully gratifying it. His bowels were regular and his evacuations normal in consistency and color. He had had many attacks of nose-bleed, but not of any intractable character. His breath was short and respirations quick, but he was able to be around on his feet.

On examination I found a child in the highest degree ema-

ciated. His lungs, except for the compression to which they were subjected, exhibited no abnormal symptoms. There was an anæmic cardiac murmur, and his pulse was over 100 in the minute and rather feeble, but not intermittent. His temperature was 100° F. His urine had a specific gravity of 1020, and combined neither sugar, albumen, casts, nor crystals. His tongue and throat were normal in appearance and of a pink hue. There were no marked lymphatic enlargements in the neck, axilla, or growths, although a few small glands could be felt just above the clavicle. His feet were somewhat swollen and œdematous. The most marked objective feature was the abdominal distention. Excepting in the right and left lumbar regions it was impossible anywhere in the abdomen to discover any intestines. An enormous liver crowded them down from above, and an equally large spleen, extending from the left kidney into the right iliac fossa, forced them into the pelvis. The spleen lying diagonally across the abdomen exhibited the usual notched edges. The kidneys could not be detected. Notwithstanding the great size of the spleen, I was able to detect a certain mobility as I pressed it up and down or from one to the other side, and was encouraged to believe that it was comparatively free from adhesions.

Dr. Ives made a careful examination of the blood, and reported as follows: "Hæmoglobin, 46 per cent.; erythrocytes, 2,070,000; leucocytes, 336,000. The erythrocytes showed a marked poikilocytosis and hæmoglobinæmia degeneration. There were among them some that were enucleated. In the normal-sized monolocular leucocytes the body of the cell was slightly stained with eosin. There were also many giant-celled leucocytes, whose large single nucleus did not stain deeply with hæmotoxylon, the body of these not taking the eosin stain at all. The bodies of the polynuclear leucocytes took the eosin stain slightly."

There could be no doubt of the diagnosis. The only question for consideration was that of treatment. That which decided me to operate was the fact that the distress which he suffered seemed due chiefly to the abdominal distention. If that could be relieved the child might live the remainder of his life in tolerable comfort.

He entered St. Mary's Hospital on June 4, 1901, at 9 A.M.; temperature was 99° F., his pulse 124; at 4.30 P.M. his temperature was 100.6° F., pulse 104; at 7 P.M. temperature 100.8°, pulse 100.

June 5, 7 A.M. Temperature, 98°; pulse, 120. 4 P.M., temperature, 101.4°; pulse, 120. Thursday, 7 A.M., temperature, 98.4°; pulse, 116. 4 P.M., temperature, 100°; pulse, 132. Friday, 7 A.M., temperature, 99.2°; pulse, 112. At 10 A.M. on Friday the operation was performed. During the three days of his hospital life prior to the operation he was put on strychnine and quinine, and was given nourishing food and nutrient enemata. As soon as he was under the anæsthetic, one and a half pints of normal salt solution were injected under the integument of both axillæ, and after the operation was completed an additional half-pint was thrown into the groins.

An incision eight inches in length was made a little to the left of the median line, through the thin abdominal walls, whose thickness was hardly that of a thick sheet of blotting-paper. There was almost no oozing from the incision. The spleen was found to be absolutely free from adhesions, and was easily lifted out of the abdomen. Its veins and arteries were tied separately and cut between two ligatures, and the whole operation was completed without the loss of an ounce of blood. I found, on hasty examination, the liver enormously enlarged. There was a cluster of enlarged lymphatic glands in the pedicle. The left kidney seemed to be of normal size. The right kidney was not examined. There was no gross evidence of pancreatic change. The pulse and respiration of the child at the close of the operation were as favorable as at the beginning, and I was very hopeful of the result. Immediately on severing the pedicle the spleen was taken by my assistant and portions of it inoculated, while warm and living, into the abdomens of three guinea-pigs.

At noon when I called the boy was sleeping quietly and breathing easily. His pulse was 130. At 1.30 P.M., temperature, 99.6° F.; pulse, 136. At 4 P.M., temperature, 103.4°; pulse, 128.

He was evidently failing, notwithstanding the saline injections and hypodermics of strychnine and digitalin. At 5.30 P.M. he died. Examination showed the dressings slightly stained with blood, but no evidence of serious hæmorrhage. A post-mortem could not be obtained.

The inoculation of the spleen's blood and substance into the guinea-pigs was made to test Löwit's theory as to the *rôle* played by contagion in producing leukæmia. From among

the animals kindly placed by Parke, Davis & Co. at my disposal, three were chosen that were, to all appearances, in perfect health. They were carefully washed and made aseptic, and their abdomens were shaved. Within three minutes after the spleen had been severed from the body my assistants had inoculated the animals, one by injection of the warm blood into the peritoneal cavity, and the others by inserting slices of the cut spleen. The animals were kept many months under observation. They showed no reaction whatever to the operations. The wounds all healed by first intention. At the end of two months one of the guinea-pigs began to show signs of an enlargement of the neck, which did not, however, seem to impair his general health and vigor. At the end of the fourth month he was killed and examined. His blood, compared with that of healthy animals of his own race, showed no variation from the normal. The enlargement in the neck was a cheesy cyst, very common in these animals. The liver, spleen, pancreas, and kidneys were normal. It was not until nine months after the inoculation that the other two were killed. They were found to be in every respect perfectly healthy.

These experiments had only negative results, and have no other significance than is thus expressed. They were made with the utmost care to secure the most favorable conditions for the growth and development of infectious germs, if such existed. The asepsis was perfect, and the inoculated material living when it was inserted. If Löwit's protozoa exist in the leukæmic spleen, guinea-pigs must possess an immunity to infection by them. It might have been well to vary the experiment by inoculating animals of various species, and also by inserting the morbid tissue into the bone-marrow, or even injecting the blood into the spleen itself.

The pathology of leukæmia in its various forms is as yet so obscure that a rational therapeutics is out of the question. Whatever we do for its cure must be done empirically. We do not know whether the lymphatic or lienomedullary forms are variations of one morbid process or are distinct diseases, nor whether the trouble begins in the bone-marrow, or spleen,

or liver, or blood. While the preponderance of evidence is in favor of the bone-marrow as the original pathological focus, this is by no means so positively established as to be beyond question. None of the operative measures hitherto adopted can be said to decide the question as to the effect which the elimination of the spleen would have on the progress of the disease, for the reason that there has not, to my knowledge, been any removal of that organ in the early stages of the disorder.

While I have not been able to obtain histories of all cases of splenectomy for leukæmia, yet I have little doubt that nearly, if not quite, all have been undertaken after the spleen had reached a large size and had become a distressing complication of an advanced disease. Thus in von Burckhard's three cases the weights of the extirpated organs were respectively five kilos, two kilos, and three kilos. In Richardson's case the spleen weighed two and a quarter kilos, in mine two and a half kilos. That, under these circumstances, with advanced degenerative changes in the blood, liver, spleen, and other tissues, the mortality of the operations should be appalling is not surprising. Nor should we expect that, even though the spleen were the original seat of morbid action, its excision would alter the result, if postponed, until these changes had taken place. It seems to me, therefore, that if we would come to positive conclusions as to the *rôle* played by this organ in the etiology of leukæmia our next step must be to eliminate it from the field early in the disease. If it could be excised while the patient is still in comparatively good strength, and when it first shows evidence of enlargement, we might draw rational conclusions as to its influence upon the course of the disorder.

Excision of the spleen in leukæmia has hitherto been done for the relief of the abdominal distention with its consequent distressing symptoms. It might possibly, with greater experience, be done early in the disorder as a curative measure. At any rate, we cannot feel safe in making statements as to the relations of the spleen to the other organs affected by the disease until we shall have pursued the course suggested above

and carefully watched its effects. We should then be able to determine positively whether splenectomy in leukæmia works to the good of the organism or to the detriment. If to the latter, then the operation should be prohibited; if to the former, then our efforts should be directed to lessening its now excessive dangers. If the elimination of the spleen from the problem should prove that the presence of that organ had no influence whatever upon the course of the disease, we might still be justified in removing it early in order to prevent the disturbance due to its size and pressure, if only the operation could be made reasonably safe.

A problem which ought to be studied in these cases is the tendency of the enlarged spleen to become adherent to the surrounding structures. The most frequent cause of death after splenectomy for leukæmia has been the hæmorrhage due to ruptured adhesions. We may hardly assume that the great size of the organ is alone responsible for this tendency to agglutination, the more especially as in some cases like my own, in which the greatly hypertrophied organ had become crowded in to an extreme degree, adhesions have not been formed. Neither, in the absence of all history of injury, may we ascribe this tendency to hurts. The fever which accompanies the degenerative change may possibly predispose to irritative processes on the splenic surface. Whatever the cause may be, there can be no doubt of the fact that adhesions between the organ and the diaphragm, liver, and abdominal wall in leukæmia are the most serious obstacles to successful surgery. For this reason, operations, if undertaken at all, should be done at the very earliest possible period, when the enlargement of the spleen has just begun to make itself manifest. At this period it is not probable that any strong adhesions would have formed; the patient would be otherwise in much better condition, and the necessity of large incisions would not exist. Instead of a very severe operation on a much reduced patient, there would be a comparatively slight operation on a person who had not yet lost his powers of resistance. The history of all other great intra-abdominal operations teaches us

that the danger is in exact ratio to the previous duration of the disease. There is every reason to believe that this history would be repeated in operations on the leukæmic spleen if it should become the rule to operate at the earliest possible period. A series of successful operations at this period could not fail to throw great light on the pathology of leukæmia. It might, indeed, very materially change our ideas as to the relative influence in the etiology of the disorder of the spleen and bone-marrow. I cannot but feel that we shall not have done our full duty in the study of this disease until we shall have altered our practice in respect to the time of operating. In a disease almost uniformly fatal, we are certainly justified in pursuing any course which may offer a hope of therapeutic success. The value of operative procedures in an early stage of the disorder has never been put to the test.

In my own operation I was agreeably surprised by the almost total absence of hæmorrhage. It is highly probable that in very early operation skilfully done, this source of danger would be almost entirely eliminated. The weight of a normal spleen in an adult varies from five to twelve ounces. If we operated when it had no more than doubled its normal size, we could remove it through a short incision in a few minutes' time. There would follow no such shock as comes from the sudden relief of great tension and pressure, and we may believe that recovery would be rapid and sure.

To be able to operate early we must, however, get our cases early, and to that end we have to appeal to the general practitioner, who alone sees these patients in the beginning of their disease. As the diagnosis depends, then, on the examination of the blood, we should preach everywhere the necessity of such examinations as routine procedure in all cases of wasting disease. The progress of medicine depends no little on the competency of the great mass of the profession, and the study of the early stages of all diseases must always be the great privilege, as well as duty, of the practising physician, who alone has the opportunity to treat them in their beginnings.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, March 26, 1902.

The President, L. W. Hotchkiss, M.D., in the Chair.

EPITHELIOMA OF THE PALATE AND TONSIL; VON LANGENBECK'S OPERATION.

Dr. George E. Brewer presented a man, aged sixty-three years, referred to him for operation by Dr. James E. Newcomb, laryngologist to the Roosevelt Hospital. The patient stated that he had first noticed symptoms of an irritable throat five or six weeks before admission. The irritation consisted of pain and soreness in the roof of his mouth, more or less constant salivation, the presence of a bad taste in the mouth, and difficulty in opening the jaws. His general appearance was that of a man who had had some serious illness, although there was not the discoloration of the skin usually present in the cachexia of malignant disease. On the left half of the roof of the mouth, about the junction of the hard and soft palate, there was an irregular-shaped ulcer about as large as a silver half-dollar, extending from a point half an inch from the median line downward to and involving the tissues of the tonsil. The borders were indurated, and there was an increased sense of resistance throughout the entire region. The ulcer itself was covered with a dirty yellowish secretion, and bled easily when this was removed. One or two small glandular masses were felt in the submaxillary triangle. As the man gave no history of traumatism, and as syphilis could be easily excluded, the diagnosis of epithelioma seemed clear, and was confirmed by all who saw him.

The question of operation was discussed; the case was apparently on the border-land regarding the advisability of a palliative or radical operation. The man readily consented to any course

which seemed most advisable, and it was deemed advisable to administer an anæsthetic, and then decide as to whether the operation should consist of a thorough removal of the growth and submaxillary tissues, or simply an excision of both carotids, as advised by Dr. Dawbarn in cases of inoperable malignant disease of the face and mouth. The patient took the anæsthetic well, and an incision was made along the anterior border of the sternomastoid muscle, through which the external carotid artery was ligated, the enlarged lymphatic and submaxillary glands and the areolar tissue of the submaxillary triangle were removed. An attempt was then made to pry the jaws apart sufficiently for an attempt at removal through the mouth. This was found to be impossible, and an incision was made from the angle of the mouth downward and outward, crossing the inferior maxilla about one inch anterior to the angle, and joining the neck incision at its upper portion. All the tissues were divided down to the bone; the latter was divided with the Gigli saw, and the severed ends drawn apart, which gave an excellent exposure of the floor of the mouth and the region of the palate and tonsil. The growth was then thoroughly removed, the dissection being carried completely through the soft tissues of the palate. On removing the tonsil, the growth was found to extend inward, involving the internal pterygoid muscle near its origin. This, together with some fibres of the external pterygoid, was removed, leaving an extremely large, deep cavity, in the bottom of which the internal carotid artery could be felt. There was very little bleeding, owing to the previous ligation of the external carotid. The divided tissues along the floor of the mouth were united, the divided ramus of the jaw sutured with strong chromicized catgut, and the external wound drawn together by means of harelip pins and silkworm-gut sutures. There was only slight reaction following the operation; the temperature rose on the next day to 101° F., and from that time on steadily declined until the tenth day, when it became normal. For the first ten days the patient was fed by means of a stomach-tube, the mouth being washed out every hour while awake with peroxide of hydrogen and boric acid solution. It is now about nine weeks since the operation. He takes nourishment well and has gained considerable flesh.

Dr. Robert H. M. Dawbarn said that the excision of the external carotids plus injection of paraffin into certain branches,

would not have added greatly to the time of the operation, and would certainly have increased the patient's chance of permanent recovery.

Dr. Dawbarn said that in the article recently published in the "International Text-Book of Surgery," upon surgery of the mouth, the author advised that, after all operations on the mouth for cancer, the patient should be allowed to sit up "as soon as possible"; with the idea that the prospect of a cure would be thereby increased. The speaker said he strongly disagreed with this view of the writer. On the contrary, he could recall at least two instances occurring in his own practice where a fatal *Schluck-pneumonie* followed excision of the tongue for cancer, from septic fluid gravitating into the larynx, the stump of the tongue being unable to control the epiglottis. In these cases, as Dr. Brewer illustrated in his patient, it is very important to keep the mouth in as aseptic a condition as possible; and also, until swallowing can occur without coughing, to maintain a position with the head slightly lower than the body, by using no pillow and elevating the foot of the bed; continuing this position for weeks, if need be.

REMOVAL OF A FOREIGN BODY LODGED BETWEEN TWO STRICTURES OF THE ŒSOPHAGUS.

Dr. Brewer also presented a patient, a male, aged thirty-one years, admitted to the Roosevelt Hospital in November last. He stated that about eight months before admission he had accidentally swallowed a quantity of lye. This produced immediately a marked irritation of the pharynx, œsophagus, and stomach, which was evidenced by severe pain and burning, nausea, vomiting, and profuse salivation. These symptoms, however, subsided, and he resumed his work. Several weeks later he noticed a progressively increasing difficulty in swallowing solid food. This became so great that he was obliged to live on fluids, until he experienced such difficulty in swallowing the latter that he applied at the Massachusetts General Hospital for relief.

An examination showed dense cicatricial strictures in the œsophagus, which would not yield to dilatation. Under anæsthesia gastrostomy was done, and the strictures divided in the usual way by sawing with heavy braided silk thread. It was found after this operation that large œsophageal sounds could be passed from below upward through the gastrostomy wound, but not from

above downward, probably owing to the presence of a diverticulum just above the lower stricture. The patient finally left the hospital and came to New York. The strictures re-contracted and he applied for further treatment at the Roosevelt Hospital.

On admission, he was found to be considerably emaciated. Nothing could be passed into the stomach from the mouth. It was decided to divide the strictures again by means of the silk ligature, and if possible to keep them open by means of bougies introduced from above. An examination of the œsophagus showed the first stricture to be located just below the cricoid. This admitted with difficulty a bulb about thirty millimetres in circumference. Another stricture of about the same caliber was found about ten inches from the teeth. A third obstruction was encountered between fifteen and sixteen inches from the teeth line, through which nothing could be passed. The patient succeeded in swallowing a fine silk thread, which was afterwards withdrawn from the gastrostomy wound by means of a bent probe. On December 4, under chloroform anæsthesia, a heavy braided silk ligature was attached to the fine thread and drawn from the mouth through the œsophagus and out at the gastrostomy wound. After thoroughly sawing the strictures, the condition of the œsophagus was examined by means of a bulbous œsophageal bougie of about forty-five caliber. The divided strictures offered some resistance to the passage of the bougie, and when it was withdrawn it was found that the bulb had separated from the staff, and remained in the œsophagus between the two lower strictures.

An attempt was immediately made, by inverting the patient, to extract the foreign body, or at least to bring it to a point where it could be reached by an external œsophagotomy. This proved unsuccessful. Several days later another attempt to remove it was made under chloroform anæsthesia. The strictures, which had already contracted, were again thoroughly divided by means of the silk saw, and a small cup-shaped snare, fashioned like a parachute, was passed from above downward until the foreign body was reached. When this was thoroughly engaged, strong traction succeeded in drawing the foreign body from the œsophagus into the stomach, from which it was easily removed through the gastrostomy opening. A No. 40 bougie was then passed every other day through the gastrostomy wound upward to the pharynx, and the patient instructed to take no nourishment, not even fluids,

except through the stomach wound. This was advised in the hope that the irritation produced by the foreign body, and the thorough division of the strictures might result in a shrinkage or possible obliteration of the diverticulum; which had up to this time absolutely precluded the use of the bougies from above. After ten weeks of this treatment, it was found that a No. 40 œsophageal bougie could easily be passed from the mouth to the stomach. The patient was then permitted to eat semi-solid food and partake of fluids through the mouth, and the gastrostomy wound was allowed to heal. He is now able to swallow practically any kind of food, and, although the gastrostomy wound is not entirely healed, he is rapidly improving.

DR. GEORGE WOOLSEY asked Dr. Brewer whether he thought the irritation caused by the foreign body in the œsophagus was really the important factor in the obliteration of the diverticulum. Experience had shown that cicatricial strictures of the œsophagus are not infrequently associated with diverticula of considerable size, which contract when the stricture is divided and kept open. In Dr. Brewer's case the stricture was kept open by means of the string-saw and the passage of bougies for a considerable time, which would account for the shrinkage of the diverticulum.

DR. BREWER said the œsophageal stricture in this case had been first divided at the Massachusetts General Hospital, where it was kept open for several months, but no instrument could be introduced into the stomach from above on account of the diverticulum, which evidently persisted during all this time. It was not very large, but just large enough to catch the end of the œsophageal bougie. The speaker said he had observed the same thing in other cases, and he was inclined to believe that the irritation produced by the presence of the foreign body had much to do with the closure of the diverticulum.

PERINEAL PROSTATECTOMY.

DR. BENJAMIN T. TILTON presented a patient, sixty-seven years old, who entered the Colored Hospital on December 7, 1901. Three days previous to his admission he had an attack of retention of urine which required catheterization. Previous to that he had suffered from frequent urination and inability to completely empty the bladder. On admission, the amount of his residual urine was found to be fifty ounces. His general condition being

very poor, he remained in the hospital for three weeks before an operation was undertaken. During that time he had to be catheterized twice daily. At the time of operation, his urine was clear. Rectal examination revealed a large prostate, its right lobe being much the larger.

On December 27, prostatectomy was performed through a Y-shaped incision in the perineum. Owing to the thinness of the abdominal wall, it was found very easy to push down the prostate from above the symphysis and remove the hypertrophied portion of the gland. The wound was drained for a week, and then healed rapidly without complication. Following the operation, there was a short period of incontinence. The amount of residual urine at present is about an ounce. He has no difficulty in urination, and the urine is clear.

In reply to a question as to whether the prostate was reached and its capsule opened through the Y-shaped incision without opening the urethra, and also whether the urethra was opened subsequently and drainage instituted, Dr. Tilton replied that he opened the capsule outside of the urethra and completed the operation in that way. The membranous urethra was then opened for the insertion of a drainage tube into the bladder.

RESECTION OF SIGMOID FLEXURE IN STRANGULATED HERNIA.

Dr. Tilton presented a patient, a man thirty years old, who was admitted to Bellevue Hospital during the evening of November 27, 1900. The only point of interest in his previous history was that he had a left-sided inguinal hernia since birth. On the morning of his admission to the hospital, while at stool, the hernia came down. He was unable to reduce it, and sent for his family physician, who also failed to reduce it under an anæsthetic.

An examination revealed a large tumor, eight inches in length and five inches in width, in the left inguinal region. There was no impulse. On opening the sac, it was found to contain a large part of the sigmoid flexure. After freeing it, it was irrigated for several minutes with hot salt solution; but as its color did not improve, it was decided to leave this portion of the intestine outside of the abdominal wound, in order to give it an opportunity to regain its vitality. Twelve hours later it was evident that necrosis of the gut was inevitable and that resection was necessary. Ten

inches of the gut—practically the whole of the sigmoid flexure—was excised, and its two ends brought together by a large-sized Murphy button, end-to-end suture being impossible owing to the shortness of the lower segment. The patient was much shocked by the second operation, but finally reacted. At the end of six days he developed a fæcal fistula, through which the Murphy button was subsequently discharged. When the patient left the hospital, three months after the operation, his wound had entirely closed. Since then he has developed a hernial protrusion at the site of the operation.

FOCAL EPILEPSY; OPERATION WITH USE OF A SPECIALLY PREPARED CELLULOID PLATE.

Dr. Robert H. M. Dawbarn presented a man, about forty years old, who was admitted to the Neurological Division of the City Hospital last April, and subsequently, early in June, transferred to the Surgical side. According to the history he gave, he had suffered from epileptic seizures for the past seven years. The convulsions occurred two or three times weekly,—sometimes at night, sometimes during the day,—and they always began in the fingers and hand of the left side, thence quickly spreading up to the face, and then he would drop unconscious.

Examination over the region of the left hand centre (right side of head) showed a distinct bony depression, just admitting the tip of the index-finger, and about one centimetre in depth; although there was no scar. On the opposite side of the head there was a narrow white scar extending backward about eight centimetres from the forehead, but no depression. These lesions were evidently not congenital, and, although the patient denied that he had ever met with an accident, the probabilities were that his memory had become weakened as the result of his epilepsy.

The latter part of June, 1901, the patient was operated on as follows: The entire scalp having been shaved, a flap of bone was removed over the left hand centre. The depressed portion of the bone was firmly adherent to the dura, and this to the pia, and the brain subjacent was a little depressed. It was thought best to remove the flap entirely. Then, with a sterilized faradic electrode, the naked copper wire, using a very weak current, the hand centre was localized, and after turning down the dura mater a section of gray matter a little smaller than a silver half-dollar

was excised throughout its entire thickness, down to the white substance. The dura mater was then closed with finest chromic catgut stitches, and the large opening in the skull was covered by a plate of specially prepared celluloid. Primary union followed. The plate has given the patient no discomfort, and since the operation he has had only two very slight convulsions, one in October and the other in December. Present examination of the patient shows the plate to be firm and rigid still.

Dr. Dawbarn showed a sample of the celluloid which he had employed in this case. It has the appearance and thickness of ordinary window glass. Celluloid, as it is usually manufactured, has been objected to by surgeons on the ground that the nitric acid which it contains is apt to prove irritating to the tissues, and, furthermore, that it has been known to be rapidly absorbed. At the St. Paul meeting of the American Medical Association in the surgical section, there was reported a case where a celluloid plate in the skull softened and yielded within a very few weeks. In this specially prepared celluloid, Dr. Dawbarn said, he had the nitric acid thoroughly washed out, and instead of using camphor for purposes of elasticity, synthetical urea was substituted. The latter is apt to be less irritating than the former. After a piece of this celluloid is immersed for a time in boiling water, it can be whittled as readily as pine wood, and bent to any desired shape so as to fit the skull. Being transparent, when placed over the opening it can be scratched exactly of the right size, and then rapidly whittled down to the line so demarcated. In the case reported, the speaker said, the aperture in the skull was somewhat less in size than a man's palm.

The strength of the hand on the affected side was greatly impaired by the operation, but it is gradually improving. The man is not taking any bromide, and will not receive any until the effects of the operation are clearly established.

Dr. Brewer said that he thought the question of cortical excision would probably receive more attention in the future than it has in the past. In one case where he resorted to it, the result was very successful. The total number of cases in which this has been done is still so limited that no positive conclusions can be drawn.

Dr. Charles L. Gibson said the immediate results after operation for focal epilepsy have been, as a rule, very encouraging, and in a number of cases reported there has been a cessation or

diminution of the attacks for some months, but we are still awaiting the reports as to the late results. Kocher attributed the early benefits of the operation to the relief of the pressure.

DR. BREWER said that in his case the immediate result of the operation was very disastrous. Instead of having three convulsions a day, as he did previous to the operation, his patient had one about every fifteen minutes. After at least six months had elapsed, the interval between the attacks lengthened, and he sometimes went for three months with only a single attack.

DR. GEORGE WOOLSEY said that a few years ago he excised the cortex in a case of epilepsy accompanied by athetoid movements of the left hand. The operation was followed by immediate improvement, but not an absolute cure. The improvement continued for a considerable period, but subsequently the patient partly relapsed into his former condition, though the epileptic attacks remained less frequent and less severe.

PERINEAL PROSTATECTOMY AFTER THREE UNSUCCESSFUL BOTTINI OPERATIONS.

DR. SAMUEL ALEXANDER presented a man who had already been shown by Dr. Alexander at a meeting of the Society on January 22 of the present year as an illustration of a case in which three Bottini operations on the prostate had proven unsuccessful.

On January 30, Dr. Alexander performed a median perineal prostatectomy, and removed from the left lateral lobe a mass measuring about two and one-half inches by two inches, together with a small median lobe. Two smaller masses were enucleated from the left lateral lobe. Perineal drainage was established. Tube was removed on the eighth day. On the thirteenth day patient was able to retain urine for one and a half hours and voluntarily passed four ounces. At the end of the month perineal wound had closed entirely, and patient was passing all of his urine through the urethra. At the present time he urinates twice at night. The urine still contains a small amount of pus.

On March 7 there was one and a half drachms of residual urine. On March 8 there were two drachms of residual urine. On March 9 there were thirty minims of residual urine. On March 10 there was no residual urine.

At the request of Dr. Alexander, the President appointed Drs. Brown and Johnson to examine the patient. They did so, and

reported that his bladder contained about two drachms of residual urine.

CAVERNOUS ANGIOMA OF THE FACE.

Dr. F. Kammerer presented a man, forty years old, who first came under the speaker's observation about a year ago. He was suffering from a large, cavernous angioma of the left side of the face, which had existed for about ten years. When Dr. Kammerer first saw him, there was a faint pulsation in the tumor, which disappeared on compression of the carotid. Ligature of the external carotid, therefore, seemed advisable before attempting to remove the growth. The operation proved somewhat difficult, on account of the downward extension of the angioma. Finally, however, the speaker was able to free the common carotid up to its bifurcation, and finally succeeded in passing a ligature around the external carotid, immediately at its origin. As soon as the ligature had been tightened, the growth decreased to about one-half its former size, and the pulsation immediately ceased. Excisions from the growth were made in several places, causing considerable hæmorrhage, and complete extirpation was therefore not deemed justifiable.

For about six months subsequent to this operation, the tumor remained comparatively small; but when the patient again presented himself, a month ago, it had resumed its former size. Dr. Kammerer again cut down upon the common carotid, and followed it upward; he found the external carotid obliterated, while the internal carotid had grown to about twice its normal size. Pressure upon the common carotid produced no apparent change in the size of the tumor, which proved that its blood supply came from another source. Compression of the right carotid did not apparently affect the size of the growth.

At this second operation, excisions of parts of the tumor were again practised, and the hæmorrhage was very severe. Some of the venous openings were at least one-eighth of an inch in diameter. Thus far the angioma had not involved the mucous membrane of the mouth.

Dr. Dawbarn said he thought the growth received its principal blood supply from the opposite side through numerous small vessels, and it could hardly be expected that tying the external carotid on one side would exert more than an evanescent effect.

Its blood supply probably came in part from the subclavian by the vertebral branches, and from many branches of the internal maxillary anastomosing with the ophthalmic and middle meningeal and various others of the internal carotid system.

As regards further treatment in this case, Dr. Dawbarn said he would be in favor of not only extirpating the external carotids, but also of plugging the terminals of these vessels and the occipital by an injection of paraffin. It is not permissible to plug all the branches, because plugging the superior thyroid will cause permanent paralysis of the vocal cords; and plugging of the linguals will interfere with deglutition, and make the tongue as rigid as a board. If the posterior auricular artery is plugged, the ear may in part slough away. The vessels where plugging is advised are those by which, chiefly, a recurrent anastomosis is possible.

In reply to a question as to how the paraffin is used in these cases, Dr. Dawbarn said the mixture he employs consists of one part of white paraffin and nine parts of white vaseline, which is liquid above 108° F. This mixture is injected at a temperature of 120° F. About forty-five minims should be injected into the occipital just where it is given off, and the same amount up to a drachm, into the external carotid just where it disappears into the parotid gland; but more than a drachm would probably be dangerous, in the average case, from its passing beyond the internal maxillary and superficial temporal branches, and entering their free anastomoses with the internal carotid. Thus far he had used this combination of excision and paraffin injection about a half dozen times; and Dr. A. T. Bristow, of Brooklyn, a few times. No one else as yet has tried it.

After a fortnight or so for recuperation, the same operation must always be repeated upon the other external carotid. It is a complete waste of time to endeavor to accomplish anything approaching permanency of shrinkage with work upon one side only.

GANGRENOUS APPENDICITIS OBSCURED BY ENLARGEMENT OF THE LIVER.

Dr. Ellsworth Eliot, Jr., presented a woman who was admitted to the Presbyterian Hospital in May, 1900, with the following history: About ten years previous to the time of her admission she had suffered from an illness which lasted almost

five months. During that time she had complained of pain in the abdomen, and the probable diagnosis was that she had an "abdominal abscess," although no operation was done.

When she entered the hospital, she had pain in the epigastric region, and there was some nausea and vomiting. Her temperature was 101° F.; pulse, 124; respirations, 32. In appearance she was apathetic. An examination of the abdomen showed some tumefaction in the right hypogastrium, and a mass could be made out extending from above the free border of the ribs down to the umbilicus. It was not distinctly movable, and was markedly tender along its lower margin. There was considerable rigidity and distention of the abdominal wall, most marked on the right side, but also noticeable on the left.

An exploratory operation being deemed advisable, a vertical incision was made over this globular mass. When the peritoneum was opened, the mass proved to be an enlargement of the liver. The incision was thereupon prolonged downward, and the gall-bladder exposed. This was found to be perfectly normal. The colon was then drawn upward through the wound, and an examination of the appendix showed that organ to be in a gangrenous condition. It was removed; the upper part of the wound was sutured in the ordinary way, and the lower part was left open to heal by granulation. The patient made an uneventful recovery, and was discharged from the hospital at the end of five weeks. The enlargement of the liver, which proved to be nothing more than a hypertrophied right lobe, still exists without apparent change.

Stated Meeting, April 9, 1902.

The President, L. W. Hotchkiss, M.D., in the Chair.

PERFORATIVE CHOLECYSTITIS.

Dr. F. Tilden Brown presented a man whom, on September 19, 1901, he had first seen while a patient in the medical side of the Presbyterian Hospital, where he had been for nine days. The following history was given: He had been found in his home by

the ambulance surgeon acutely delirious. On reaching the hospital, temperature was 103° F.; pulse, 120; respirations, 44. Heart action very poor, perspiring profusely, and surface very cold.

Present illness began about two weeks before, with severe frontal headache and great irritability. One week later began to have abdominal pain in the right upper quadrant. He became very feverish, and has so remained until the present time. No nausea or vomiting; bowels moved one to three times a day; said to have passed large quantities of dark-colored urine. Two days before admission patient began to talk disconnectedly and gradually became delirious. No convulsion; no cough, but rapid breathing. Abdominal pain, earlier very severe, had lessened in last few days. He had had one chill the day before admission. Habits, mildly alcoholic.

The patient was a very corpulent man, well nourished. Tongue rather dry, slightly coated to whitish fur. Spleen not made out. Urine, brownish red, 1020 acid, heavy brown sediment. Granular and hyaline casts in great abundance. Ten per cent. albumen.

The abdomen was prominent; distention very marked, tympanitic to percussion; that on right side being of duller variety. Rigidity of muscles of right side. Apparently some tenderness over liver region, where dulness began at third space, becoming flat at fourth rib, continuing to five inches below the costal margin in parasternal line.

Two days later the abdomen was less distended. No longer has pain; still generally tympanitic. There is dulness in the right flank, not shifting; no fluid wave obtained.

Two days later, September 16.—There was an undefined sense of a mass extending as far to the side as the anterior axillary line. All trace of albumen has disappeared from urine.

September 19.—Abdomen less distended. Mass still felt. Widal tests have been negative. Leucocytosis has ranged between 19,000 and 48,000.

Dr. Brown diagnosed cholecystitis, but because of the extreme lateral position of the tumor, had the possibility of abscess in mind. Under gas and ether a six-inch vertical incision was made over the most prominent part of tumor, *i. e.*, downward from tip of tenth rib. As the peritoneum was opened, a large

quantity, estimated at a quart, of stinking pus and blood gushed out. This was found to come from a walled-off peritoneal cavity of very irregular surface. Some pockets eight or nine inches from the surface. The half hand introduced could not touch the bottom, but sponge forceps found there a single loose calculus of pigeon-egg size. Looked at hastily, it was thought to have no facets. What was believed to be the outer surface of the gall-bladder could be traced for a short distance above. Search for an opening in it from which the stone was believed to have escaped was futile. A long irrigating curette was used cautiously to cleanse the various pockets of muco-pus and blood. Cavity drained with large tube and partly packed with gauze; wound partly closed with chromic gut.

Culture from the abscess. Large non-pathogenic bacilli.

Except for a profuse bloody discharge from wound on third day, perfect convalescence, and left hospital twenty-six days after operation, with a small sinus discharging mucus.

Later examination of the calculus when cleansed of mucus showed slight facets at one extremity. Had this been noted at time of operation, the gall-bladder and cystic duct would have received more searching attention.

MORRISON'S OPERATION FOR CIRRHOTIC ASCITES.

Dr. Brown presented a man, forty-six years of age, who for two years after Morrison's operation had been recovered from an ascites due to cirrhosis of the liver. For the detailed history of the case, with general remarks upon the operation, see page 191.

Dr. George E. Brewer said that as this patient had remained in good health for over two and one-half years since he was operated on by Dr. Brown, he demonstrated very conclusively that certain cases of ascites due to cirrhosis of the liver can be cured by this operation. Dr. Brewer said he had recently collected fifty-one cases that have been published, and of these there have been six absolutely cured of their ascites and remaining well after two years. Six others have been cured of their ascites and were perfectly well when they were last seen, which was less than two years after the operation. In a communication received from Dr. Osler he stated that he had seen several successful cases. In view of these facts, Dr. Brewer said, the operation was certainly justifi-

able. White, of London, has shown that the average duration of life of patients suffering from cirrhosis of the liver, with ascites, in uncomplicated cases, is only about eight or nine weeks after the first tapping.

EXTIRPATION OF RETROPERITONEAL TUBERCULOUS GLANDS.

Dr. Willy Meyer presented a woman, thirty-five years old, who was operated on three times at the Strasburg Clinic for tuberculous glands,—twice in the neck, and once in the left inguinal region. She came to the German Hospital last summer suffering from tuberculous glands in the right inguinal region, which gave her a great deal of pain. For the purpose of removing these, Dr. Meyer operated on July 27, 1901. Upon carefully stripping the peritoneum from the diseased glands, it was found that the inflammatory process extended backward to the retroperitoneal region. Not having permission for a more serious operation, only the glands in the groin were removed as thoroughly as possible, and in the course of time the patient was discharged from the hospital. Subsequently she returned, complaining of a good deal of pain along the right crural nerve, and insisting upon another operation. This was done on December 11 last. The usual incision for ligating the external iliac artery was made, and in order to get sufficient space, the inner half of the former incision was again opened. After exposing the field of operation, the ureter was pulled aside, and by careful dissection Dr. Meyer was able to remove the enlarged glands from the side of the vein. No vessel was injured. Layer sutures were applied and the wound closed with gauze and tube drainage. In any other region, Dr. Meyer said, he would have disinfected such a wound with iodoform, but he refrained from using it here because of the danger of iodoform poisoning. On account of the recumbent position of the patient, the wound did not drain well, and he found it necessary to make a counter-opening (intermuscular) above. The subsequent course of the case was uneventful.

Dr. Meyer called attention to the fact that in these cases the affected retroperitoneal glands are usually located below the common iliac artery, very rarely above.

PROSTATIC HYPERTROPHY CURED BY BOTTINI'S OPERATION.

Dr. Willy Meyer presented a man fifty-two years old, who in August, 1896, after ingestion of a great deal of ice-cold liquid, had first experienced trouble in micturition. A physician advised sounding and irrigation of the bladder. Infection followed, also inflammation of the right testicle. There was a call for micturition every half-hour to one hour day and night. At one of our public hospitals vesical irrigation was carefully carried out for many weeks. In December the right testicle was removed. After the operation the patient was somewhat improved. The frequency in micturition decreased and the urine cleared up. But in April, 1897, recurrence of the former symptoms with considerable pain in the suprapubic region set in. Urination occurred about every forty-five minutes; dysuria was present. Little improvement followed, though the bladder was continually washed for a whole year.

When Dr. Meyer first saw the patient on April 28, he urinated every fifteen to thirty minutes in the daytime; nights every hour to an hour and a half. With some effort he passed 150 cubic centimetres; residual urine, 175 cubic centimetres. The catheter, left within the bladder, after the latter had been thoroughly irrigated until the water returned clear, soon gave exit to a small amount of turbid urine. There surely existed pyelitis. The prostate on rectal palpation was found to be equally enlarged in both lateral lobes, and sensitive. Its upper border could be reached. As a result of urinary analysis a diagnosis was made of secondary hyperæmia of the renal parenchyma or more marked lesion; chronic cystitis without alkaline fermentation. Cystoscopy showed a large prostate, trabecular bladder; probably pyelitis on the left side, as the urine expelled from the left ureteral opening appeared cloudy.

May 7, 1898, Bottini's operation was performed at the German Hospital.

The first two days following the operation the patient felt very much benefited. Whereas he had had to get up during the night every hour to an hour and a half to urinate, and that always with pain, micturition now was at once rendered easy. Thus the report of the night from the 18th to the 19th of May was: The patient voided urine voluntarily between 10 and 11 P.M.; next

between 3 and 4 A.M.; and next at 6 A.M. Using the patient's own words, he "certainly passed the best night for the last twenty months." On the third day the traumatic irritation of the gland began to produce greater frequency of micturition; then incontinence appeared for a short time, most prominent during sleep. There was no vesical irrigation; urotropine was administered internally. A short time after the operation the patient left the hospital. He had no further local treatment. On June 15 he reported that he was urinating every hour and a half to two hours during the day, but he could wait longer if he wished; during the nights, he waits about three to four hours; at times he has to strain rather long before the bladder is completely emptied. The former pain has disappeared. He feels and looks better, and has gained in weight.

Dr. Meyer said the history of this case was included in a paper on this subject which he read before the New York Academy of Medicine in November, 1898. The patient was subsequently lost sight of and did not present himself again until very recently. Since then, Dr. Meyer said, he had not yet had an opportunity of examining the patient's bladder for residual urine, but he would do so, and report the result at a future meeting.

The patient complains of no symptoms referable to the prostate at present, and he is able, without the slightest hesitation, to pass a full stream of perfectly clear urine.

CHOLELITHIASIS.

Dr. Alexander B. Johnson presented three cases of cholelithiasis.

Case I.—R. R., aged forty-three years, was admitted to the New York Hospital, March 19, 1902, with a history of repeated severe attacks of pain referred to right hypochondrium, associated with chills, fever, bile-stained urine, clay-colored stools, vomiting, and other symptoms of biliary obstruction during the past thirteen years. From time to time, also, numerous small biliary calculi have been passed per rectum.

For the past two months the pain and constitutional disturbance from which the patient has suffered have been on the increase; jaundice, if present, has been slight during this time.

Present Condition.—Patient is fairly nourished. Temperature and pulse normal. Slight jaundice. Constipation. Urine, a small

amount of bile. Abdominal wall lax. Liver easily palpable two inches below free border of ribs. Gall-bladder not felt.

Operation, March 21.—Gas and ether narcosis; incision four inches long at anterior border of right rectus muscle. Liver pushed upward; beneath it a distended gall-bladder completely filled with large and small stones. Palpation of common duct negative. Subperitoneal extirpation of gall-bladder. Cystic duct explored, no stones found therein. Cauterization and ligature of stump of cystic duct. Suture of peritoneal folds formerly enclosing gall-bladder. Rubber tube and gauze-wick drainage. Suture of abdominal wound. Aseptic healing. Bile-stained stool on second day. Cessation of pain at once, and normal convalescence. The gall-bladder contained two very large and numerous small calculi.

Case II.—E. M., aged twenty-two years, was admitted to the New York Hospital, March 18, 1902. Two months ago this patient began to have attacks of cramp-like pain in the right hypochondrium radiating to the shoulder and back, accompanied by chilly sensations, fever, and vomiting, but no jaundice. These attacks have been repeated every few days since. They have lasted from twenty-four to forty-eight hours, and have confined the patient to bed. Four days before admission to the hospital, an attack set in, and the patient noticed twenty-four hours later that she was jaundiced, and that her urine was very high-colored. Stools not noted. Bowels regular. The pain has shifted to the epigastrium in the median line.

On admission, the patient is well nourished and in good general condition. She is markedly jaundiced. The abdomen is flat. There is tenderness on deep pressure in the right hypochondrium and in the epigastrium. The liver does not appear to be enlarged. The gall-bladder could not be distinctly felt. The urine contains much bile. The stools are clay colored. Temperature, 100° F.; pulse, 106; leucocytes, 10,000.

The following morning the patient was put under gas and ether. A vertical incision was made along the outer border of the right rectus muscle three and a half inches long, beginning above at the free border of the ribs. The gall-bladder was found distended. Palpation of the common duct between a finger introduced into the foramen of Winslow and the thumb detected a small hard mass low down in the common duct.

With some difficulty this portion of the duct was brought into view, and a small incision over the hard body permitted the extraction of a spherical calculus about the size of a pea. The removal of the calculus permitted the escape of a considerable quantity of bile-stained mucus. The gall-bladder then collapsed.

The cut in the common duct was sutured imperfectly with fine catgut. The exposed viscera were cleansed with salt solution and dried. Closure of the wound in the abdominal wall. Drainage with a rubber tube and a strand of gauze down to the hole in the common duct.

There was no rise of temperature following the operation nor any disturbance of wound healing. A large movement of the bowels, containing abundant bile, on the second day. Drainage removed on the third day. Stitches removed on the eighth day. The jaundice had notably diminished after three days, and had entirely disappeared after ten days. The patient was allowed to sit up on the twentieth day. Urine and stools normal.

CASE III.—H. H., forty-six years of age, was admitted to the New York Hospital, February 13, 1902. During the past eight years she has suffered from numerous severe attacks of pain in the region of the gall-bladder. The attacks lasted for several days, and were often followed by jaundice. During the past four years the attacks have recurred every two months or so. During the past three months the patient has had severe attacks of biliary colic, and the jaundice has been constant, with remissions. The last attack began four days before admission to the hospital. The pain lasted two days and a half, accompanied by a chill followed by fever.

At the present time the patient is well nourished; she is deeply jaundiced. The abdomen is soft. The liver extends an inch below the free border of the ribs in the nipple line. There is tenderness in the region of the gall-bladder upon deep pressure. The urine and the stools are characteristic of biliary obstruction. The coagulation of the blood is notably delayed.

February 14, under gas and ether anæsthesia, a three-inch vertical cut was made at the outer border of the right rectus beginning above, an inch below the free border of the ribs. The gall-bladder was found rather deeply placed beneath the liver. Moderately distended. Palpation detected a stone of considerable size in the gall-bladder. Palpation with the finger introduced into

the foramen of Winslow detected two large stones in the common duct. Gall-bladder opened, permitting the escape of bile-stained mucus. A single stone, measuring three-quarters of an inch in its greatest diameter, was abstracted by means of a scoop. Efforts to move the stones in the common duct upward into the gall-bladder were not successful. An incision of the common duct behind the duodenum, permitting extraction of two stones of about the same size as the first. Suture of the common duct and the gall-bladder with fine silk. Cavity cleansed with salt solution. Closure of the wound except for a small rubber drainage tube and a strand of gauze which were introduced down to the wound of the common duct. Sterile dressing.

There was a slight escape of bile into the dressing for about forty-eight hours; after that time, none. The tube was removed on the third day, after which a small gauze wick was inserted a short distance for several days longer.

The movements from the bowels contained bile on the third day. The wound healing was aseptic, producing a linear scar. The disturbances of pulse and temperature during convalescence were unimportant. The patient left the hospital on the twenty-fifth day well.

Dr. Johnson, in reply to a question as to whether the gall-bladder should be left open or closed, said that when the interior of the organ was in an infected condition, it would be desirable to drain it. In the third case reported by him the condition of the gall-bladder seemed to be quite aseptic, and there were apparently no indications for leaving it open.

Dr. Meyer said that in one of his cases of so-called ideal cholecystotomy he was able to close the gall-bladder at once. The contents were apparently aseptic, and immediate closure seemed to be the proper thing to do. It did not give rise to the slightest disturbance.

RUPTURE OF THE SPLEEN.

Dr. George Emerson Brewer presented a boy, aged fourteen years, who was admitted to the First Surgical Division of Roosevelt Hospital on May 31, 1901, suffering from pain in the epigastric region. He stated that the day before, while riding his bicycle he was thrown violently over the handle-bar, severely contusing the abdomen by striking a rock. The pain at first was

severe, and he vomited a small quantity of fluid material. After a few moments, however, he was able to rise, and walked to his home, a distance of more than a mile. The pain continued; he was placed in bed, and after a few hours expressed himself as being more comfortable. The following morning as the pain seemed more severe and the abdomen was markedly tender to the touch, he presented himself at the hospital for admission.

On examination his temperature was found to be 103° F.; pulse, 132; respirations, 36. The face was pale, the extremities cold. There was great tenderness over the upper portion of the abdomen, most marked in the epigastric and left hypochondriac regions. There was muscular rigidity over the entire abdomen, although more marked in the upper third. No dulness was made out in the flanks.

As the pulse seemed extremely weak and thready, he was immediately prepared for operation. Under chloroform anæsthesia an incision three inches in length was made in the median line just above the umbilicus. As soon as the peritoneum was opened, there was a gush of dark-colored blood from the wound. Exploration with the hand showed that there was a very large amount of blood in the peritoneal cavity. The incision was at once extended both upward and downward, reaching from the ensiform to the pubis. As soon as the abdominal cavity was opened, the anæsthetist reported that the boy was pulseless. He was given immediately hypodermic stimulation and an intravenous infusion of 1500 cubic centimetres of normal salt solution. While this was going on, a careful exploration of the abdominal viscera was made, which revealed the presence of a large rent in the external surface of the spleen almost dividing the organ into two halves. The hæmorrhage was violent, and was only controlled by stuffing the wound full of gauze and pressing it securely against the diaphragm.

After arresting the hæmorrhage in this manner, the patient was completely eviscerated and large quantities of clotted blood removed from the flanks and the pelvic cavity. The intestines were cleansed with large quantities of salt solution, replaced in the abdomen, and the incision united by means of through and through sutures of silkworm gut. A small cigarette drain from the pelvic cavity emerged at the lower angle of the wound, while the large gauze packing was brought out at the upper angle. The

patient was sent to the ward in an extremely critical condition, and was immediately given a hot coffee enema and hypodermic injections of strychnine, whiskey, and digitalis. He rallied somewhat, and in the evening the temperature had dropped to 99.4° F., pulse 128, and slightly improved in quality. The patient vomited considerably during the night and the following day, and no attempt was made to nourish him. During the second night his condition grew worse in spite of the most vigorous stimulation, and on the following morning his temperature was 104.5° F., pulse between 150 and 160. The abdomen was distended, and there was constant vomiting of small quantities of dark-colored foul-smelling fluid. The face was extremely pale, was bathed in cold perspiration, and he seemed to be dying. At the earnest request of his mother, but with little or no hope of improving his condition, he was again taken to the operating-room and given a large intravenous infusion. This so improved the quality of his pulse that they were able to give him a few whiffs of chloroform and reopen the wound. As the intestines were injected and in places covered with lymph, the entire abdominal cavity was washed out with a very large volume of salt solution. A counter-opening was made in the left flank, through which the end of the gauze which plugged the splenic wound was passed. The median incision was again united, leaving a fresh cigarette drain in the pelvic cavity.

After his removal to the ward, he was vigorously stimulated, but lay in a condition of extreme shock for many hours. The following day he seemed somewhat better. The bowels moved, the vomiting stopped, and he took a small amount of nourishment. With the exception of two or three sharp rises of temperature, his condition continued to improve. At the end of seven or eight days the gauze packing was removed from the wound in the flank and replaced by a small wick of sterile gauze. From this time on the history is uneventful. He made a complete recovery, and was discharged from the hospital on July 7.

Dr. Brown said the expedient resorted to by Dr. Brewer to control hæmorrhage in his case may prove of great value to others under similar circumstances, or even where the patient could probably tolerate a splenectomy. He asked Dr. Brewer whether, in such a case, he would again resort to the method of plugging the splenic wound, or some modification of it, and also whether,

at the time of operating, he would make a dorsal incision for the subsequent removal of the gauze.

Dr. Brown said he had done splenectomy in three cases of rupture of the organ, all resulting fatally. In two of these cases the rupture resulted from a comparatively trivial injury. One of the patients was a man, who, while standing on a chair, tipped over and fell on the floor. The second case occurred in an iceman, who, while lifting ice from the wagon, was punched in the ribs by the driver. In the third case, the exact circumstances were forgotten, but the injury resulted from quite a serious fall. In one of the cases the operation was done eight or nine hours after receipt of the injury; in the others it was not permitted by relatives until a greater lapse of time, and when very serious symptoms had supervened. In two of the cases the pedicle of the spleen was compressed between the fingers while an elastic ligature, spread and held taut on a large grooved tunnelled sound, was passed around it. It was noticed that the compression with the fingers controlled the bleeding very effectually, but other methods proved less successful. The bleeding vessels were finally secured. None of the patients lived over thirty-six hours. In his cases, the speaker said, he made the left lateral incision, below the margin of the ribs secondary to one through the outer margin of the left rectus. He had never resorted to evisceration, and unless the bleeding could be temporarily but quickly checked on opening the abdomen, he thought it would be a serious matter to take time for evisceration in order to gain freer access to the spleen.

Dr. Brewer said the case he had reported was the second one of ruptured spleen that had come under his care during the past year. The other case was a boy who had apparently received only slight contusions of the body. He was brought to the hospital at midnight, and Dr. Brewer saw him the following morning. He was then looking pretty white, and it was decided to operate at once. The spleen, which was four or five times its normal size, was found to be ruptured. The abdominal incision was at once enlarged, the rent in the spleen was plugged with gauze in the same way as in the case already reported, and then the organ was pushed up against the diaphragm. The patient recovered from the effects of the operation, and for a number of days did perfectly well. The gauze was subsequently removed through a lumbar incision, and the stitches partly taken out. Subsequently, the

patient began to develop an irregular temperature, and finally he died. On the day before his death his blood was examined, and gave a distinct Widal reaction. It was learned afterwards that he had just passed through an attack of typhoid, and his injury had evidently brought on a typical relapse.

THE TREATMENT OF PROSTATIC HYPERTROPHY ASSOCIATED WITH STONE IN THE BLADDER BY MEANS OF LITHOLAPAXY AND BOTTINI'S OPERATION AT ONE SITTING.

Dr. Willy Meyer read a paper with the above title, for which see page 17 of July number of Annals of Surgery.

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, April 7, 1902.

The President, RICHARD H. HARTE, M.D., in the Chair.

RENAL CALCULUS IN A CHILD OF TEN YEARS.

DR. THOMAS R. NEILSON said that a girl, ten years of age, came under his care at St. Christopher's Hospital for Children in November, 1900, with the history that for some two years previously she had been subject to attacks of pain, sharp and lancinating in character, in the right loin, radiating downward and extending to the anterior and inner aspect of the thigh. At the time of these paroxysms, which occurred as often as once a week, the urine was, as described by the parents, very bloody.

When Dr. Neilson first saw the child, she was pale, anæmic, and feeble in appearance; her pulse was 100, weak, and irregular in character. The urine, which presented a cloudy, bloody looking sediment, contained albumen, pus, blood, and uric acid crystals.

The general condition was such that it seemed to him highly injudicious to submit the patient at once to an operation of the gravity of nephrolithotomy, for it was evident that any loss of blood, however small it might be, would be ill borne. Accordingly, the child was placed in bed, carefully watched for symptoms, and fortified by diet and treatment for the necessary operation. She gained strength but slowly, and it was several weeks before he considered her strong enough to undergo it. On but three occasions in the interim did she have attacks of renal colic, two of them being of but a few minutes' duration. Twice the operation was delayed by intercurrent troubles,—a cold with croupy attacks, and a sore throat.

The urine was repeatedly examined, and the microscope showed that it generally contained some blood-corpuscles and pus-cells, although no blood was visible to the naked eye after the

first examination made on the day of admission. There were noted on several occasions crystals of uric acid, amorphous urates, and phosphates. The reaction of the urine was uniformly acid, and the test for albumen usually was positive in result.

The diagnosis of renal calculus was confirmed by a skiagraph taken by Dr. Charles L. Leonard. This showed the presence of a stone in the pelvis of the right kidney at the lower pole.

Operation was performed on January 9, 1901, Dr. H. C. Deaver assisting. Dr. Neilson made the incision preferred by Mr. Henry Morris for exploration of the kidney and ureter, which afforded easy and ready exposure of the organ. The kidney was freely movable downward; the result, no doubt, of the long-continued attacks accompanied by straining. Delivering it through the wound, a small stone was easily felt at the lower extremity of the renal pelvis; the blood-vessels being firmly compressed between the thumb and fingers, an incision through the cortex readily enabled him to extract it with small stone forceps. A careful search was made to see if any other concretions might be present, but none were discovered. The wound in the kidney was packed with a strip of iodoform gauze to control oozing and to act as a drain, and the kidney was then replaced, a thick loop of iodoform gauze being first passed beneath both the upper and lower ends of the organ to hold it in position, the ends of the loop being brought out of the wound, which was packed with more iodoform gauze, sutures being employed only at the extremities.

The calculus, which is of irregular shape, weighed twelve and one-half grains; its greatest circumference being thirty-three millimetres, and its shortest twenty-five millimetres. In its long axis the diameter is thirteen millimetres, crosswise it measures nine millimetres, and its least diameter is six millimetres. At one extremity it comes almost to a sharp point near which its surface is rough and uneven, and at two other places groups of crystals protrude from the otherwise smooth surface.

Part of the gauze packing was removed in a few days, the loops not for some ten days. At this time the surface of the kidney, which could be seen partly in the wound, was covered with healthy granulations.

The little girl bore the operation well and made a good convalescence, being allowed to get out of bed in five weeks. Since her recovery she has remained perfectly well so far as urinary symptoms are concerned.

SARCOMA OF THE LEFT SUPERIOR MAXILLARY BONE IN A CHILD OF ELEVEN.

DR. NEILSON presented a boy, eleven years old, who was admitted to St. Christopher's Hospital on January 2, 1902, with the history that something over a year previously he had been struck on the left cheek by a base-ball, and that soon afterwards a tooth (the first bicuspid) came out, and a small swelling on the jaw was observed. This growth had gradually increased in size, more noticeably shortly before the child's admission to the hospital. When first seen by Dr. Neilson, there was a marked prominence of the left cheek, and inspection revealed the presence of a tumor, the surface of which was traversed by several good-sized veins, the growth apparently springing from the body of the superior maxilla, extending downward as far as the alveolar border, upward into the antrum, and encroaching inward upon the hard palate. Measurements taken by the Resident Physician, Dr. G. J. Ewing, from whose notes the data for this report were gathered, showed that the tumor extended upward to within half an inch of the infra-orbital margin, outward to within one-eighth of an inch of a line drawn perpendicularly from the external canthus, and inward to within one-fourth of an inch of the nasal septum.

Inquiry into the family history elicited the statements from the boy's parents, both of whom are living and healthy, that his maternal grandfather had been operated upon for a tumor of the groin, and that an aunt, also on the maternal side, was said to have had a cancer of the breast. Besides the patient, there are three other children in the family, all living and well.

A blood examination made by Dr. Ewing on January 6 gave the following result: Red blood-corpuscles, 5,184,000; white blood-corpuscles, 13,500; hæmoglobin, 68 per cent. On January 29 another examination was made, the report being, red blood-corpuscles, 5,120,000; white blood-corpuscles, 17,300; hæmoglobin, 90 per cent.

On February 7, an operation, in which he was assisted by his colleague, Dr. H. C. Deaver, was performed.

With the head well elevated, the patient in a semi-reclining position, the Fergusson incision was made, and the entire bone was removed. There was no excessive loss of blood, and the boy bore the operation well until just after the removal of the bone, when he suddenly collapsed. Stimulating hypodermic injections

and oxygen were given during the closure of the wound, and immediately after the child was returned to his bed, a few minutes later, he was given normal saline solution by hypodermoclysis. The shock was severe, and for some time the condition remained critical. Reaction, however, occurred before long, the temperature rising by 7 P.M.—some five hours after the operation—to the remarkable height of 106.8° F. The boy made a good recovery.

The growth was submitted for examination to the pathologist of the hospital, Dr. William Pepper, who reports that it was a giant-celled sarcoma. Surrounding it was a thin layer of bone as though the latter had been pressed out.

A blood count made on April 4, two weeks after the boy's discharge from the hospital, showed but little change in the number of leucocytes as compared with the count made just after admission to the hospital. The figures from the latest count are, red blood-corpuscles, 5,060,000; white blood-corpuscles, 13,000; hæmoglobin, 65 per cent.

DOUBLE ANKYLOSIS OF HIPS FOLLOWING COXALGIA.

DR. JOHN H. JOPSON showed a girl, aged fourteen years, on whom he had operated one year previously for contracture of both hips following coxalgia. The patient also had a very marked kyphosis in the dorsal region, the result of Pott's disease. Both hips were much contracted, the left hip firmly ankylosed, the right hip partially so. She moved about by swinging herself along between crutches, and when standing rested in a crouching attitude, her hands and forearms supported on her thighs. The left hip was straightened by sawing the femur below the trochanters; and dividing subcutaneously the sartorius, the tensor vaginæ femoris, and the adductors. The right thigh was brought down without cutting the bone, after subcutaneous tenotomy of the adductors and division of the tensor vaginæ femoris, the sartorius, and the long head of the rectus muscle through one open incision. The result was better than expected. The limbs are of almost equal length, the patient walks very well with one crutch, and for short distances without any. She uses a chair which permits her to sit in a semi-reclining attitude. The operation shows the wisdom of preliminary myotomy and tenotomy in fibrous ankylosis, as recommended by Lorenz, before dividing the femur. Attempts have

been made by Volkmann and others to secure a movable joint in these cases by chiselling out a new joint, to avoid the difficulty in sitting which is present after simple osteotomy. Where both hips are ankylosed in bad position we have a choice of three procedures (Hoffa). (1) The formation of a new joint on both sides (Studensky and Maas). (2) The performance of double subtrochanteric osteotomy. (3) Resection and formation of a movable joint on one side, and simple osteotomy on the other side (Volkmann and König).

Dr. De Forest Willard remarked that cases of multiple tubercular foci demand careful attention. Where there is a spinal caries and a tubercular disease in one hip or, as frequently happened, in both hips, the resulting deformities are so great that the locomotion of the individual becomes almost an impossibility. The child shown has been improved from 50 to 75 per cent. by operation. She is still crippled, yet moves about without even crutch or cane, and will be able in time to take long walks and accustom herself to the new position. In ankylosis following a spinal caries and one following hip disease, especially if the ankylosis is at right angles, progression becomes so difficult that the individual is obliged to almost bow himself to the ground at every step. The rigidity of the spine renders it impossible for the lordosis or anterior bending to occur, which would otherwise take place to accommodate this ankylosis of the hip. This calls for osteotomy; and while the ultimate fixation of the hips in nearly a straight line to the body renders sitting much more difficult than in the former conditions, yet with a narrow chair and high back the patient is able to support himself partially lying and partially sitting, with moderate comfort. The new position of the hips is, of course, for a time difficult, and patients are obliged to throw the body from side to side, but they gradually accommodate themselves to this condition, and are able to have free and comfortable locomotion. It is an operation that should always be done in these cases. They should never be allowed to become helpless cripples, incapable of voluntary locomotion.

Dr. J. K. Young said that he had seen several cases of double osteotomy for hip-joint disease, and in one he attempted to remove a wedge-shaped piece of bone after the method described. Motion kept up for several days, but ankylosis finally occurred. He did not think it possible to produce a movable joint after an operation of this kind.

Dr. G. G. Davis thought that in ankylosis of both hips the condition is so deplorable that an effort ought to be made to get a movable hip. The difficulty, however, that will be encountered, in all likelihood, in cases due to coxalgia is that they show a large amount of new bone thrown out about the joint, that the operation is apt to be such a severe one as almost to preclude its being done. The simple apposing of the ends of the divided bone, as would occur after a linear osteotomy, he would always expect to be followed by union, and nothing but the removal of a wide amount of bone would give a movable joint.

TENDON TRANSPLANTATION TO RELIEVE LEG PARALYSIS FOLLOWING ANTERIOR POLIOMYELITIS.

Dr. Jopson also showed a boy of eight years suffering from paralysis of the extensor longus digitorum and peroneal muscles of the right leg, the result of anterior poliomyelitis. To relieve the equinovarus he had transplanted the tendon of the healthy tibialis anticus to the two outer tendons of the extensor longus digitorum after division of the plantar fascia. As the operation had been done only one month before, and the bandage had been cut only a few days, it was too early to foretell the ultimate result. There had been as yet no restoration of function. The operation of tendon transplantation, although twenty years old, had only attracted much attention in the last few years. Nicoladoni, in reporting his first operation in 1882, laid down what were still recognized as essential features in the technique, viz., to secure moderate tension of the transplanted tendon, to approximate surfaces of tendon extensive enough to promise firm union, and to prevent premature strain upon the tendon by providing support of the part for a considerable period after operation. The operation is still in the stage of development as regards its application to various regions. The most recent advancements have been in the attempts made to overcome the paralysis of the quadriceps so common as a result of anterior poliomyelitis. Among these are the plan of suturing the sartorius and external hamstring muscles to the quadriceps extensor (Bradford); and the transplantation and suture to the patella itself of the biceps tendon on the outer side by perforating the vastus externus, and of the tendons of the semimembranosus, semitendinosus, and gracilis on the inner

side, bringing them through an opening in the vastus internus (Krause).

Dr. De Forest Willard said that tendon transplantation is one of the operations which can be used in quite a number of cases with very great advantage. The difficulty in employing it lies in the fact that in a very large number of cases there is no tendon which one can borrow, since all the neighboring muscles may be paralyzed. Where there is a lack of equilibrium, one can borrow from the stronger and attach it to the weaker side, whether in the foot, leg, thigh, or arm. The transplantation of the entire tendon or a part of it is very helpful. The peroneal engrafted upon the tendo Achillis will often give sufficient power to raise the calcaneum if proper gymnastics are pursued.

Dr. G. G. Davis said that it is certainly gratifying to note the effect which is produced in a successful case after a transplanted tendon has begun its work. Usually, before operation, the foot is stiff and more or less locked. After transplanting, if the muscle begins its work, the foot seems to become more supple; and, of course, you have, in addition, the advantage derived by the action of that muscle in the functions of the foot. He had recently transplanted the semitendinosus to the quadriceps, perforating the vastus internus, and the muscle was regaining its action when the boy went home. He had also transplanted the anterior tibial to the extensor muscles as well as the peronei to the tendo Achillis.

NON-DEFORMING CLUB-FOOT.

Dr. J. H. Jopson also reported the case of a girl, aged sixteen years, who had scarlet fever in childhood and typhoid fever four months ago. Trouble with her feet was noted more than eighteen months ago, the exact date of onset being uncertain. An increase in the arch first attracted attention. Later she complained of pain in the thighs and knees after walking, and developed a peculiar and awkward gait. It was noted that the ball of the foot struck the ground first. There was no muscular weakness, as she was able to walk long distances in spite of the pains which persisted up to the time of observation. When first examined, it was noted that the patient was rather short in stature, and underdeveloped for her age, a bright, intelligent girl, but indisposed to physical exercise. There is nothing, aside from the condition of

the feet, to attract attention. There is no lateral curvature. Examination of the feet shows an increase in the height of the plantar arch, more pronounced in the right but also present in the left foot, associated with contraction of the plantar tissues. A very tight band of plantar fascia is observed on the inner side of the right foot. There is contraction of the calf muscles in each leg, resulting in inability to flex the foot to a right angle on the right side, or beyond a right angle on the left. Passive stretching is equally ineffectual. There is no loss of power apparent in the anterior muscles of the leg, the inability to flex the foot being due to the contracture of the calf muscles. There is a peculiar condition of the great toe of the right foot, consisting in an overextension of the first phalanx and a flexion upon it of the second phalanx. This is present to a minor degree in the outer toes of the right foot. The muscles of the legs are poorly developed, but no distinct wasting is present. The knee-jerks are normal.

It was apparent that stretching would not suffice for the contractures in the right foot; the plantar fascia and tendo Achillis were at once divided under anæsthesia, and the foot put up in an overcorrected position in plaster of Paris, which was retained for five weeks, the patient being permitted to walk on the cast after three weeks. A pair of light braces was then applied, consisting of a steel sole plate with a light bar fastened to the inner side and extending upward to a point just below the knee, where it was fastened by a band. There was a stop-joint at the ankle preventing extension of the foot beyond a right angle, and the foot was fastened to the plate by a band making pressure over the arch. The shoe slipped on over the brace after adjustment, and as the upright piece was lacquered, the brace was almost invisible. This brought both feet into good position, and the use of the braces was followed by steady improvement. After a couple of months she was sent to the Orthopædic Gymnasium of the University Hospital and active and passive corrective exercises ordered. She has now improved to such a point that the braces have been left off. There is a slight tendency to contraction of the left tendo Achillis, which was not divided; but this is yielding to the gymnastic exercises.

This case is a good example of the class of cases described by Newton M. Shaffer, in 1885, under the title of "Non-deforming Club-foot," a name which has been retained by most writers.

An examination of the systematic text-books on orthopædics written since that time adds very little to the admirable description of the affection as given by Shaffer. Whitman includes it as one of the two subdivisions of the so-called "contracted foot," under the head of "compound variety," and identifies it with the condition described by Fisher, of London, in 1889, as talipes plantaris. For a concise description of the deformity, one cannot do better than refer to Shaffer's original description. He describes the deformity as one in which "all the conditions found in certain forms of talipes exist with the exception of the exaggerated deformity. That is, there is a loss of normal relation between the articulation at the ankle and the muscles which act upon it, involving, also, in many instances, the tarsus, producing a condition which prevents normal flexion at the ankle-joint, and modified mobility, with slight deformity at the tarsal, metatarsal, and phalangeal articulations." In other words, the whole complicated mechanism of the foot and ankle are thrown out of equilibrium, and the pain, deformity, and disability which are present in all grades and degrees are the results. The etiology of the deformity is one of the most interesting features connected with it. That such a condition may and frequently does result from a temporary or permanent extensor palsy, the result of an anterior poliomyelitis, is of course unquestioned. According to Whitman, a mild poliomyelitis or neuritis occurring in childhood is the cause in most instances, often following scarlet fever or some other acute infection, and while recovery is apparently complete, a slight weakness is left which, during adolescence or adult life, develops into the condition described. The "talipes plantaris" of Fisher, with which Whitman identifies it, is certainly a deformity of paralytic origin, as Fisher expressly states. Among the causes which Shaffer enumerates as etiological factors are anterior poliomyelitis, traumatism, the infectious diseases of childhood, especially diphtheria and scarlet fever, and malposition, habit, etc. There still remains what might be called the idiopathic form, by far the most interesting because the most obscure, to which the case reported belongs, in which there is no evidence of any spinal cause, no history of traumatism, neuritis, or long-continued malposition, and which is observed, according to Shaffer, more frequently in the female sex, especially in those whose growth has been apparently arrested before the average

height is reached. The very frequent association of lateral curvature and non-deforming club-foot, which he states were present in more than 50 per cent. of his cases of scoliosis, led Shaffer to look for some common cause, and this he views probably some trophic lesion in the motor tracts of the brain, resulting in a misdirection of growth, affecting first the muscles, later the joints and other structures, and causing now a torticollis, again a scoliosis, again a foot deformity. Whatever the cause of this class is indications all point to a central nervous origin.

While Shaffer treated his cases successfully by the application of his extension shoe, the indications for rapid correction by division of contracted structures in cases of any severity are generally recognized. The application of some simple and convenient retentive apparatus is of benefit after correction, and whatever course of treatment is employed, it should include a thorough course of gymnastic exercises to develop the muscles of the anterior aspect of the leg, which would seem to be the most rational means of preventing recurrence.

ANGIOMA OF FACE; REMOVAL AFTER LIGATION OF EXTERNAL CAROTID ARTERY.

Dr. W. Joseph Hearn reported the case of a child, four months old, who was brought to the Jefferson Hospital with an angioma the size of a large walnut in front of the ear. It was first noticed as a small red mark soon after birth. When admitted the tumor measured one inch by one and a half inches, and stood off from the side of the head one inch. It did not pulsate. From its color, there was a large admixture of venous with the arterial vessels. As dissecting out the tumor was the only means of removing it, and as it was fed by large vessels from external carotid, he first ligated that vessel. The hypoglossal nerve served as an excellent guide to the vessel. After ligation of the external carotid, the tumor was removed without loss of any blood. One large artery supplied the tumor.

PERINEAL DISLOCATION OF HIP.

Dr. W. J. Hearn reported the following case: A man sixty-eight years of age, weighing 200 pounds, five feet five inches high, on stepping out of his door on ice, one leg suddenly separated

from the other and he fell backward. He was unable to arise. He was carried to bed. Dr. Hearn saw him the next day, and found much suggillation in the perineum. The great amount of fat prevented him from feeling the head of the bone in its new position as satisfactorily as he could have wished; but there was extreme abduction of the limb, and the knee stood far out from his body at an angle of sixty degrees. It was impossible to abduct the corresponding limb to the same degree. There was some shortening. Reduction was easy under an anæsthetic. Recovery with a useful joint followed. He reported the case on account of its rarity. Stimson reports but three cases of his own, and recorded cases are not numerous.

THE ACTION OF X-RAYS ON INOPERABLE CANCER.

Dr. W. Joseph Hearn reported the case of a man, aged forty-five years, who came to the Jefferson Hospital, October 3, 1901, with the following history: Ten weeks previous to admission he discovered an ulcerated lump on the inner side of his right jaw, which he thought was a gum-boil. It grew rapidly, and on admission was twice the size it was when first discovered. He was somewhat emaciated, and complained of gastric disturbances and constipation. The disease involved the mucous membrane at the angle of the jaw and extended to the membrane covering the pterygoid plates. An incision from the commissure of the lips to the angle of the jaw was necessary to expose the tumor, which was removed, but not satisfactorily, as the growth ramified in every direction. Three months later the tumor had returned, and its location and size made it inoperable. X-rays were then used twice weekly by Dr. Buchanan with a most gratifying result. The tumor has almost entirely disappeared, but that the disease is eradicated, the reporter did not pretend to claim. The health of the man has much improved, and altogether he is greatly benefited to a degree that no other treatment could accomplish. Dr. Hearn could not explain how the rays act, unless they cause a fibroid change in the cells of the growth, and this diminishes their power of proliferation.

In a second case, in the person of a man, seventy years of age, who was operated upon in Jefferson Hospital in July, 1900, for an epithelioma of the ala of the nose, a degenerated wart which

he had for twenty years, there was complete removal and no return of the disease for eighteen months, when it again returned not only in the scar tissue, but also in the gum of that side. It was very painful. He neglected to return until the tumor was very large and involved much structure. His age and general health precluded an operation. The X-rays have reduced the tumor at least three-quarters of its original size and diminished pain. He has also been under the care of Dr. Buchanan.

Dr. De Forest Willard said in cases of epithelioma treated by the X-rays, the preliminary step to the application should be the removal of a large portion of the growth itself. By this means are removed millions of diseased cells, and the X-rays have a very much better opportunity to do their work. Their effect does seem to be favorable and hopeful.

Dr. Richard Le Conte said that his experience in epithelioma and its treatment by the X-rays had been limited to two cases. Both had epithelioma of the nose. In the first woman there was an involvement of the glands of the neck and also a portion of the lower eyelid. This case was treated by the X-rays; sometimes one treatment a week, sometimes two were given for a period of several months. For the first eight or ten weeks an improvement apparently took place. At the end of that time the growth on the nose remained in about the same condition for a period of two months, and then it rapidly grew worse, ending fatally possibly six or seven months after the X-ray treatment had begun.

In the other case, also a woman, there was a small area of ulceration on the tip of the nose, but, as far as discernible, no other portion of the body was involved. In this case the X-rays were applied two or three times a week, and there was a slow improvement. The ulcerated area cicatrized and the growth apparently diminished in size, but after three months it was still not cured. Induration was still present, although the ulcer had healed.

Dr. Francis T. Stewart said that he had had a case of an extensive epithelioma of the neck and side of the face under treatment by the X-rays for the past month. The patient is an elderly man, who has never submitted himself to an operation. The growth in the neck soon ulcerated, so that at the present time there is an immense irregular excavation in the side of the face and neck extending from the ear almost down to the clavicle, a clearly

inoperable case. It had been making rapid progress, the pain was very severe, and the discharge extremely fetid and profuse. He was put under the X-ray treatment, Dr. Mitchell, of the Pennsylvania Hospital, applying the treatment every second day. In a short time it was distinctly noticeable that the progress of the ulceration had been hindered; it had not been stopped; and there was no cicatrization; but it was not growing as rapidly as it had been. The discharge had markedly diminished, and the fetid character was entirely absent; the pain had practically disappeared. The patient had gained some in general health and his mental condition was very much better; it had been a ray of hope to him, for he had been told that some cases were cured by X-ray treatment. While this case does not promise much because of its extensive character, it does prove that there is a marked benefit from the rays in lessening the fetor, in ameliorating pain, and in prolonging life. The patient has been under treatment for a month.

Dr. John H. Gibbon said that after the recurrence took place in the man, described by Dr. Hearn, he came every day to the dispensary to have the growth dressed. The growth projected far out from the cheek and was about the size of a hen's egg, or even larger. At this time the odor he carried about him was so disagreeable that they had to give the dispensary over to him or else hurry his dressing. The picture shown was taken three days after the treatment was begun, when great improvement was shown.

In another case, a woman had an epithelioma, which extended over nearly the entire one-half of the nose. She had submitted to two operations. It was at first diagnosed lupus, but later the diagnosis of epithelioma was confirmed by the microscope. In this case complete healing took place, the result being very impressive.

Dr. Buchanan said that he was not so sanguine about the permanent cure of these cases as some other physicians who had used the X-rays for therapeutic purposes. He cited a case of lupus, the first of the kind treated by him with the X-rays. A man came to the hospital in August, 1901, with a patch of lupus in the region of the glabella about the size of a quarter, which had existed for a year and a half. He had been treated by the family physician during that time, who had used various forms of treat-

ment, without any response. He also curetted this area once. When he came to the hospital, Dr. Buchanan subjected him to the X-ray treatment. After sixteen exposures of five minutes' duration each, twice a week, the lesion had entirely disappeared. He was discharged at the end of this time as cured. After three months he came back to the hospital with the same condition existing as before. He stated that the sore had returned one month after his discharge from the hospital. He was again subjected to the X-ray, and after eight exposures with the time and distance as before, the lesion disappeared, and he was again discharged, which was two months ago. Whether it has recurred again or not, Dr. Buchanan did not know.

The case of cancer of the nose cited by Dr. Gibbon, involving the entire nose, had been under treatment for four years at the Jefferson Hospital. She was subjected to various modes of treatment in the surgical department for three years. As the sore made but little progress, she was then referred to the skin department, where she went at stated times for one year. She was then referred back to the surgical department, with the suggestion that it would be advisable to remove the nose. Dr. Da Costa suggested that we try the X-rays, and after eight exposures of five minutes' duration each, the patient being seated twelve inches from the tube, and the face being protected with a papier-mache mask covered with lead foil, a complete cure had apparently been effected. She then disappeared from the hospital, and up to the present time they had not been able to locate her. Dr. Buchanan further said that a great deal had been said about the kind of tube to be used. The majority of X-rays experimenters have said that the low tube is the better. A soft or low tube is one that gives but a faint shadow of the fluoroscope. He believed, however, that a strong tube, that is, one that will make a good skiagraph, is the best for all-around purposes. Furthermore, a high tube is less apt to burn than a low tube. The proper distance of the patient from the tube is about twelve inches, as the danger of a burn increases as the square of the distance decreases from the tube.

Dr. Hearn made the statement that the cure of cancer may be due to some fibroid changes produced by the X-rays in the tissues. Dr. Buchanan's theory is that it is due to some trophic disturbance in the trophic nerves of the blood-vessels and skin, and the fact that a burn or an erythema does not present itself for

some time after the exposure, and the progressive character of said conditions, he believes supports his theory. As a cancer is a pathological new growth, he believed the trophic disturbance in the blood-vessels of these growths causes it to atrophy and disappear, just as an epithelioma of the tonsil is caused to atrophy by the ligation of the carotid arteries.

The only case apparently completely cured in his experience is that of the old lady with the cancer of the nose. His experience had not led him to be very sanguine about the complete cure of all cases. If he were to make longer exposures and take chances of burning his patients, he would probably make more rapid progress. Whether this is advisable or not remains to be seen by further experiments.

ACUTE INTESTINAL OBSTRUCTION CAUSED BY AN ENTEROLITH.

DR. A. D. WHITING reported the case of a woman, aged sixty-eight years, who was treated in the German Hospital about one year ago for chronic rheumatism and chronic interstitial nephritis. At that time she complained of pain in the right iliac fossa. Vaginal examination revealed a hard, freely movable mass which was thought to be an ovarian tumor. Radiographic examination was negative. The patient had been an invalid for years, and had suffered greatly from persistent constipation.

Three days before her second admission to the hospital, the patient experienced a sharp pain in the lower abdomen. This was followed by complete obstruction of the bowels, and later by vomiting, which became fæcal in character. On admission, the abdomen was remarkably distended, the walls being tense and rigid. There was much pain in the lower quadrant, with tenderness on pressure, most marked in the right iliac fossa. Vaginal examination was negative; a rectal examination was not made. The temperature was 99° F.; pulse, 108, and respirations, 28. The pulse was intermittent.

Under ether anæsthesia an incision was made through the right rectus muscle, above the pubes. When the peritoneum was opened, a distended portion of the ileum bulged into the wound. Immediately below this was collapsed bowel, which was drawn into the wound and traced towards the distended portion. These merged into each other about four feet from the cæcum, with

but slight indication of the point of obstruction. The bowel was perfectly free, there were no bands or adhesions, the pelvic organs were normal. Examination of the bowel to the proximal side of the seat of obstruction revealed the presence of a hard, oval-shaped mass within the lumen. This mass was worked towards the collapsed bowel, and was found to engage in the beginning of that portion of the intestine. It had probably been displaced during the manipulations. It was removed through a longitudinal incision made opposite the attachment of the mesentery. The bowel wound was closed with two layers of silk, and the bowel then returned to the abdominal cavity. The external wound was closed with through and through sutures of silkworm gut and a dry dressing applied.

The patient left the operating-table in fairly good condition, the pulse being 116, intermittent, but of good volume. She reacted well, but was drowsy and had considerable abdominal distress. A purgative enema was followed by a free escape of flatus which afforded much relief. Uncontrollable vomiting began about twenty hours after the operation, and the patient gradually grew weaker and more drowsy until she died about fourteen hours later.

A partial post-mortem examination showed that the proximal portion of the bowel had not regained its tone, and was still distended; the distal portion had returned to its normal condition. The intestinal wound was in good condition. Both kidneys showed decided interstitial change. Death was attributed to the general infection consequent upon the interference of the functions of the intestine, complicated by the lesions in the kidneys.

The mass which had been removed from the intestine proved to be an enterolith, with a small body forming the nucleus. It weighed a little over an ounce (33.5 grammes) and measured two and a half inches (fifty-seven centimetres) in length and one and three-eighths inches (thirty-five centimetres) in width.

An examination of the stone made by Dr. A. O. J. Kelly, in the Pathological Laboratory of the German Hospital, proved the stone to be a true enterolith, with a small mass of inspissated fæces as the nucleus. There was an absence of cholesterin or other constituents of the bile, thus excluding a diagnosis of gall-stone which might have been made.

Treves, in his monograph on "Intestinal Obstruction," divides enteroliths into three classes:

"1. Concretions formed in great part of phosphate of lime, or of phosphate of magnesia, or of the triple phosphates, or stones formed of mixtures of these salts. Such calculi on section show a concentric arrangement of chalk-like or dirty white layers. With such layers alternate others of a brownish color. In outline they are oval or rounded, and often appear to be polished by peristaltic movements. They would appear to be always formed around a nucleus of some indigestible substance. Among such may be mentioned vegetable fibres and husks, hair, fruit-stones, biliary calculi, pieces of bone, and little foreign bodies that have been accidentally swallowed.

"2. Enteroliths of low specific gravity and of irregular form, which are porous in appearance and have the consistence of compressed sponge. They are composed mainly of densely matted masses of vegetable fragments mixed with particles of fæcal matter, and with a certain amount of calcareous material similar to the above species of stone." These are known as "oat-stones" or avenoliths.

"3. Concretions formed of insoluble mineral matters that have been swallowed as medicine. These are most frequently composed of magnesia."

The present case belongs to the first class.

Enteroliths usually lodge in the large bowel, especially in the cæcum. They may be found in the rectum, more rarely in the ileum, and in false and true diverticula. Kassai has reported a case in a female, thirty-six years of age, who had had abdominal pains for fourteen months. A long, hard, movable tumor could be palpated in the left iliac fossa. On account of an existing cachexia, a diagnosis of malignant new growth was made. A large dose of castor oil was administered, which resulted in the evacuation of three enteroliths varying in size and the disappearance of the supposed malignant growth.

Enteroliths are of very slow formation and may lie dormant for years. It is very probable that the supposed ovarian tumor found at the first examination of the patient was this enterolith which had lodged temporarily in a coil of bowel occupying a position near the right ovary. As stated above, no ovarian tumor was found at the time of operation.

Enteroliths very rarely cause acute, sudden occlusion of the bowel. Their presence is usually noted by long-continued digestive disturbance with occasional attacks of pain, and always associated with constipation. The main symptoms indicative of their presence, as noted by Treves, are those of persisting, incomplete, and inert obstruction of the bowel which may continue for years.

Dr. W. L. Rodman recalled a case of intestinal obstruction caused by an enterolith which was in the practice of a former colleague in the Kentucky School of Medicine, Dr. J. M. Holloway. It was an enterolith in the ileum, exactly the same shape as the bowel, more like a section of a large corn-cob than anything else. That case was operated, but was also fatal, the patient dying within a few hours after the operation.

Dr. Robert G. Le Conte described a case of acute obstruction of bowels due to a large gall-stone which occurred in a woman of sixty-seven years of age, a stout, large, plethoric person, of probably gouty history, with an enlarged and weak heart.

This woman suddenly developed symptoms of complete obstruction of the bowels. After vomiting had begun, one or two enemas, with some concentrated purges, caused a movement of the bowels with flatus. Operation at this time was not undertaken. She had some three movements, the distention of the abdomen which had previously been present subsided, and a large amount of flatus passed. A few hours later symptoms of obstruction again presented themselves; vomiting again appeared, and in the course of two hours became stercoraceous. At this time operation was undertaken, and the following condition was found:

Incision was made in the median line below the umbilicus and a portion of the intestine speedily presented, which was very much thickened, congested, and felt hard and indurated as compared with the rest of the small gut. This portion was six to seven inches in extent, and was probably in the middle portion of the ileum. The inflammation had extended into the mesentery, and from this appearance it portended a very speedy gangrene and death of the part. Shortly below this inflammatory area, a dark body was seen through a normal part of the gut, which on section of the intestine and removal of the body proved itself to be a gall-stone of almost pure cholesterin. It was three and a half inches at its greatest circumference by two inches at its least circumference.

A probable theory which will explain the inflammation of the bowel is that this gall-stone became impacted, producing the first attack of obstruction, and permitting the bacterial invasion through all the coats of the bowel and into the mesentery. As the result of active purgation in concentrated form, the stone was dislodged from its position in the small intestine and passed on, but the damage it had left behind caused the second attack of obstruction.

At the operation, this portion of inflamed bowel was resected, and an end-to-end anastomosis done with the O'Hara forceps. The case terminated fatally in a few hours. Microscopic sections of the resected bowel showed a destructive inflammation of a gangrenous order, with the presence of numerous cocci and bacilli.

INDEX TO SURGICAL PROGRESS.

GENERAL SURGERY.

I. Blood-Pressure during Ether and Chloroform Narcosis. By Dr. C. Blaull (Tübingen). These pressure experiments were conducted with Gärtner's tonometer, and they are of value because, in contradistinction to earlier experiments on animals, they were limited to human beings narcotized for operative indications.

The operative interference as well as loss of blood might appear in a measure to adversely offset these pressure observations. The latter, though, is of slight moment, and is counterbalanced by elimination of psychical impressions, which would influence blood-pressure without a narcotic. On the other hand, these experiments are weighty, since they are pursued under the actual conditions when narcosis is called for.

In one hundred ether narcoses for all possible major operations a distinct type of pressure curve could be recognized,—viz., a pressure above the normal in 79 per cent., wanting in 9 per cent. of the cases largely comprising females.

A group of cases with a very slight lowering of pressure was found in individuals past the fiftieth year. Severe illness and profuse perspirations tended to minimize pressure.

A comparison of ether pressure before and immediately after narcosis set in is not tenable, since psychical factors of the preanæsthetic period artificially heighten pressure, but on the whole not in a single instance was the pressure persistently lowered.

In the period of awakening, a lowering of blood-pressure below the normal occurred in one-third instances. Ether was

administered with a Juillard mask, chloroform with Koppeler's modification of Junker's apparatus. Chloroform was given in thirty-seven instances, twenty-five pure and twelve with morphine in addition. The influence of morphine tested in normal individuals demonstrated the absence of any influence on blood-pressure. The type of chloroform blood-pressure curve, when given pure or as a mixed narcosis, shows a subnormal pressure in 90 per cent. Individuals past fiftieth year comprise a large number of cases with increased blood-pressure, and children under fifteen years are exclusively represented in instances of greatest diminution of blood-pressure. This observation is contradictory to a popular current belief that children bear chloroform well.

Furthermore, the largest proportion of narcoses were half narcoses, so that very early in the administration of chloroform the blood-pressure is lowered, whereas with ether any lowering of number of cases with increased blood-pressure, and children under and prolonged. Finally, upon awakening from chloroform in 27 per cent. of the instances blood-pressure is normal; 46 per cent. it is subnormal.

A final comparison of ether and chloroform shows, with the use of chloroform, a curve of great fluctuations tending to a lowering of pressure on the whole; with ether as an anæsthetic we have always a curve marked by high pressure.—*Beiträge zur klinischen Chirurgie*, Band xxx, Heft 2.

MARTIN W. WARE (New York).

ABDOMEN.

I. Pathology and Therapy of Strangulated Hernia. By DR. RUDOLPH BUNDSCHUH (Heidelberg). The material constituting the basis of this paper is made from a study of 231 cases all operated within the aseptic era. Femoral (109) and inguinal (112) strangulated hernia were encountered in like frequency. The strangulation of herniæ increases in individuals

after the fiftieth year with greater frequency. In contrast to this infant life seems to be minimally affected.

Strangulation followed most commonly in individuals who casually a single time left off their trusses for herniæ always theretofore reducible. The mortality is directly proportional to the duration of strangulation, and inflammation of hernia could be differentiated from a strangulated hernia with great difficulty. The theory as to cause of strangulation seems to be settled in favor of elastic compression.

Changes in the urine were characterized in many instances by the presence of a large quantity of indican. In 6 per cent. of cases albumen was present. Under these circumstances, in every instance a loop of intestine was contained in the sac, and such cases as died showed acute parenchymatous nephritis.

Every possible form of hernia was encountered, and forty times the loop was gangrenous. The nineteen instances of Littré hernia were never diagnosed, and all were met in femoral hernia. The appendix was thrice encountered as the sole content of the sac, but cause for its strangulation is not assigned. Bacteriological examination of the fluid in the sac showed micro-organisms present in 60 per cent., though fluid was often clear.

Taxis has been practised less and less as operation has grown in safety. Prior to operative interference lavage of the stomach is resorted to, and where possible infiltration anæsthesia is favored. The incision was always very liberal, as affording the best insight, and the constriction was divided from within only if the finger could be introduced.

In estimating the degree of strangulation, attention should be mainly directed towards the afferent loop.

For gangrenous herniæ, fourteen artificial ani were made, ten died; twenty-four cases subjected to primary resection with the use of Murphy button, eight instances death followed.

If possible a radical operation should always follow, unless there exist contra-indications, extensive phlegmons of the hernial

sac, and in resection. If the union be not judged secure and, finally, if peritonitic signs be encountered. To combat the paralytic ileus following operation, the use of opium was diminished and the bowel emptied on the second day by enemata of 100 cubic centimetres of oil, repeated until flatus was manifest. The effect of laxatives tends to increase the secretion of the bowel, thus adding toxins to those septic contents already in the bowel. At times, though, opium is indispensable. Only the severest cases were subjected to anus præternaturalis. The choice favoring resection is ofttimes difficult, since the patient would collapse; on the other hand, too little interference leaning towards artificial anus is also wrong.

Objections to artificial anus are the dangers of peritonitis from afferent loop, possibility of perforation, and the possibility of inanition and the necessity of a difficult second operation, with dangers incident to it. Mortality attendant on artificial anus was 70 per cent.; upon primary resection, 8 per cent.

A particularly frequent complication subsequent to herniotomy is pneumonia of lobular type, not merely an aspiration pneumonia, but pneumonia of embolic origin from septic thrombi of the intestinal loop. Once a peculiar condition was encountered long after herniotomy,—viz., stenosis of the bowel at the site of the relieved strangulation traceable to original inflammatory conditions. The total mortality was 18 per cent. in contrast to 45 per cent. in preantiseptic days, and 36 per cent. in the earliest days of antisepsis.—*Beiträge zur klinischen Chirurgie,* Band xxxi, Heft 2.

MARTIN W. WARE (New York).

BONES AND JOINTS.

I. Operative Treatment of Congenital Dislocation of the Hip. By DR. A. CADWELLA (Bologna). Pursuant to a study and personal observation of seventy-six cases of congenital hip dislocation, the author offers the following suggestion in the

treatment of this affection. He has observed some cases born with the dislocation incompletely developed, in which instances there is merely the disposition to a subsequent complete dislocation dependent on abnormal anatomical development of the femur, characterized by an anteversion of the upper end of the femur. Increased intra-uterine pressure is held responsible for these changes of femur and acetabulum. The inward rotation of the flexed knee brings about an inversion of the lower end of the femur and the acetabulum at the same time becomes flattened. If the thigh at the age of walking be extended with the patella pointing to the front, the upper end of the femur appears rotated outward. In this unstable condition the muscles tend to displace the femur, and the acetabulum at the same time becomes flattened. muscle and soft parts tilt the pelvis forward and oblige the femur to wander posteriorly. In the forward type of dislocation the capsule lies between the head and the ilium, and thus becomes intimately adherent to periosteum. The compensatory torsion of the femur at its upper end and the adherent capsule are the greatest obstacles to perfect reduction. The plan of treatment is as follows:

Between the ages of three and twelve the bloodless methods of reduction are practical, and in 53 per cent. the results may be judged as good. The remainder of cases are reluxations not as severe, and are therefore styled transposition. Inward rotation is of service when there is torsion of the upper end of the femur and may be maintained in this position by plaster of Paris or by Schede's apparatus. Extreme degrees of torsion have to be modified by the operative procedure of Schede-Doyen. After reduction of dislocation the thigh is rotated until the neck of the femur is in the frontal plane, then a gold-plated nail is driven through the trochanter in the axis of the neck into the acetabulum. A plaster-of-Paris dressing envelops the thigh and the upper one-third of the leg in flexion. After ten days the lower two-thirds of the plaster is removed and osteotomy of the femur in

its lower one-third is performed; the leg is then rotated till the patella points forward. Immobilization then follows for one and one-half months.

If the adherent capsule be the obstacle to reduction, it should be loosened by (extra-articular operation) chiselling it from the periosteum and then reduplicating it by two stitches. This traumatic irritation favors reconstruction of the acetabular ridge. If the capsule has to be divided to facilitate reduction, author's specially constructed lever will be found of service. In instances where the acetabulum has to be hollowed out, the separated capsule should embrace the head of the femur and obviate absolute ankylosis. The incision favored to gain access to the hip is to be made along the anterior border of the tensor vaginæ femoris, and, if necessary, thence along the iliac crest dividing the insertions of the tensor vaginæ femoris, glutæus medius, and glutæus minimus. The wound is not to be drained, but completely closed. —*Zeitschrift für orthopädische Chirurgie*, Band ix, Heft 2.

MARTIN W. WARE (New York).

GENITO-URINARY ORGANS.

I. The Treatment of Prostatic Hypertrophy. By DR. E. GOLDMAN (Freiburg). A new method is herewith presented, which purposes to restore the anatomical relations of the bladder, and thus overcome the mechanical disturbances engendered by enlargement of the prostate,—viz., incontinence and retention. The bases of this operation are the observations of Waldeyer, that, if the bladder be fully distended, the urethra is shortened because of the arrangement of the muscular fibres that go to make up the internal sphincter, and which also give to the bladder a line of direction. When this line of direction is altered by overdistention, retention and overflow ensue.

To overcome these the author has planned at one and the same moment to lift up that part of the bladder which makes up the *bas-fond*, and also to widen the internal urethral orifice by

exerting traction on the anterior bladder wall and perform a ventrofixation of the bladder.

When punctio vesicæ was a very common procedure for the relief of retention incident to enlarged prostate, the improvement in subsequent urination was occasionally commented upon. A like benefit followed the practice of cystostomy. The author attributes the success in either instance to adhesions which sprang up between the bladder and abdominal wall about the site of puncture or cystostomy wound. These instances, in conjunction with two cases subjected to a "ventrofixatio vesicæ" which relieved the mechanical difficulties of enlarged prostate, substantiate the efficacy of this method. This operation is suited to cases free from cystitis and very early in the development of prostatic enlargement, at any rate before too severe a degree of atony has ensued.—*Beiträge zur klinischen Chirurgie*, Band xxxi, Heft 1.

MARTIN W. WARE (New York).

II. The Diagnosis of the Functional Power of the Kidney. By DR. L. CASPER (Berlin). Before performing a serious operation on a kidney, it is of importance to investigate, not merely if the other kidney is healthy, but if it is capable of sufficient work for the preservation of the patient. The functional power of the kidneys is measured by their products, the urine being gathered separately and simultaneously from both organs. The anatomical condition is shown by the presence of pus, albumen, casts, red corpuscles, and micro-organisms. There are three methods of learning the functional power of the kidneys, viz., the amount of secretion in a given time, the freezing point of the urine, and the amount of sugar secreted after a subcutaneous injection of phloridzin. The freezing point measures the molecular concentration of a fluid; the greater the number of molecules dissolved in a fluid the lower is the freezing point below that of distilled water. The greater the number of molecules which the kidneys abstract from the blood, *i.e.*, the greater the functional activity of the kidneys, the lower is the freezing point of the

urine. Normally, this point is one to two degrees below that of water.

It has been proved that phloridzin acts directly on the kidneys, and that, unless these are functionally capable, there will result no excretion of sugar on the administration of the drug. The author has demonstrated in the healthy that the urine from each kidney has practically the same freezing point, and the same amount of sugar is excreted after the administration of phloridzin. In disease all these three factors are lowered on the affected side.

The author believes that the above method of examination combined with the older ones permit a more exact diagnosis in renal diseases and a more reasonable prognosis in the case of operation.—*Verhandlungen der deutschen Gesellschaft für Chirurgie, Centralblatt für Chirurgie,* July 20, 1901.

JOHN F. BINNIE (Kansas City).

III. Results of Castration for Tuberculosis Testis. By DR. E. HAAS (Tübingen). The material which is the basis of this article comprises 111 cases of tuberculosis testis,—forty-four right-sided, thirty-four left-sided, fifteen bilateral castrations, and eighteen instances in which castration of one testicle was followed by castration of opposite side at a later period. Each operation was radical in the sense that a large piece of vas deferens was resected. No trust is placed in the less radical procedures of resection of the epididymis, since macroscopic exploration of the testis cannot reveal tubercles so minute in the testis as almost to evade detection by the microscope. Clinical experience furthermore has proven that in all cases where the epididymis was diseased longer than two months an affection of the orchis coexisted. Therefore castration is the best therapy for tuberculosis testis, and the burden of proof rests with the advocates of resection of the epididymis that the latter is a better procedure. The conclusions of the author are that this affection is most common in the third decade of life, during the acme of sexual activity. Cold and traumatism were responsible factors in 16.5 per cent. of

the cases, and but 5 per cent. of the cases bore any relationship to an antecedent gonorrhœal epididymitis. Cases with kidney and bladder complication offer a bad prognosis as regards both cure and viability. Twenty-six per cent. of the cases were afflicted with tuberculosis of other organs. Simultaneous involvement of both testes is rare, occurring about 3.5 per cent. Sooner or later the opposite testicle becomes diseased in 38 per cent. of cases. The chances of invasion of the orchis increase with the duration of the disease. Even after unilateral castration the remaining testicle becomes diseased in 26.7 per cent. of the instances. Among the cases of unilateral disease, one-sided castration effects a permanent cure in 44.6 per cent., whereas bilateral castration for disease of both testicles offers a permanent cure in 56.7 per cent. With unilateral castration sexual potency is maintained, and in none of the instances of bilateral castration were any of the much talked of somatic changes brought on. After unilateral castration, 20 per cent. die within the first three years, particularly of urogenital tuberculosis, 9.2 per cent. Following bilateral castration, the mortality is 40.6 per cent. for the first three years. Thus the mortality within the first three years is greater for bilateral than for unilateral castration, but after the lapse of three years more cases of double castration are cured than where unilateral castration is practised.—*Beiträge zur klinischen Chirurgie*, Band xxx, Heft 2.

IV. The Surgical Treatment of Renal Tuberculosis. By Dr. O. Siman (Heidelberg). Thirty-five cases operated by Czerny, subjected to a critical analysis, confirm in the main well-established facts, that renal tuberculosis is more commonly unilateral, with greater frequency encountered in women, and the maximum number of cases occur between the ages of thirty and forty. Hereditary taint, tuberculosis of other organs, and gonorrhœa dispose towards its occurrence. The pathological classification of Israel is endorsed.

(*a*) Caseous disease of the kidney with disease of the capsule.

(*b*) Primary ulceration of the papillæ jutting into the pelvis.

(*c*) Numerous miliary tubercles scattered about the kidney parenchyma.

The first is the most common form, represented by thirty cases in this series. The second variety was not at all encountered. The last variety, usually being an accompaniment of general miliary tuberculosis, is bilateral, and not amenable to operation. In one instance only curetting of the superficial tubercles was resorted to. Complications of the entire urinary tract were encountered in varying degree. The kidney—capsula propria—offered all the changes peculiar to the life history of the tubercle,— caseation, fatty degeneration, sclerosis. Lymph glands at the hilus were affected in one case. A very frequent complication is disease of ureter in thirteen instances, and the bladder in the same number of instances. The genitals were only twice afflicted. In combined vesical and renal tuberculosis, the hæmatogenous or urinogenous origin, *i.e.*, the descending or ascending course of the malady, is difficult to establish. The average urine was cloudy and acid, containing no more than 1 to 2 per cent. albumen. In 27 per cent. of the cases, tubercle bacilli were found. The symptoms most commonly encountered embraced renal pain (twenty-five); cloudy urine in all; a tumor was to be felt in twenty-seven cases; initial hæmaturia, thrice; albuminuria, twenty-nine times; tenesmus, seven times. Where, as in most instances, a careful study of the cases enables one to establish the diagnosis of renal tuberculosis, the cystoscope is of incalculable value in throwing much light on the local conditions, and when ureter catheterization of the opposite kidney is possible, the gain is great.

Treatment.—Internal medication only becomes of great value when supplementing surgical procedures. The incision (Czerny) was transverse. Nephrostomy was performed six times. Opera-

tive mortality, 0 per cent.; subsequent death, four (57 per cent.); cured, 4.5 per cent.; improved, 13.6 per cent. Eleven times primary nephrectomy was performed, secondary nephrectomy sixteen times.

Most of the times the capsule was left behind. For the pedicle the rubber ligature was abandoned and replaced by silk. Where possible, the ureter was resected for a short distance. Out of twenty operated cases, results, 59.2 per cent., sixteen patients were cured and seven improved. The operative mortality of primary nephrectomy is 18.1 per cent.; that of secondary nephrectomy, 6.02 per cent. Comparing 59 per cent. cures of nephrectomy with 4.5 per cent. cures in nephrostomy, it is self-evident that the former is preferable; but the latter is indicated when the kidney is converted into a pus sac, and if the kidney be secured by adhesions; if the opposite kidney be diseased or absent and when cachexia is marked and the diagnosis uncertain. A primary nephrectomy is the ideal procedure if the disease be early recognized. It implies one operation, one narcosis. The total result of thirty-five cases is, seventeen (48.5 per cent.) are living, thirteen (37 per cent.) cured. This latter figure could be raised to 68 per cent. if the cases that lived but three years were included, as well as those dead from associated tuberculosis elsewhere.—*Beiträge zur klinischen Chirurgie,* Band xxx, Heft 1.

MARTIN W. WARE (New York).

RECTUM AND ANUS.

I. Retrograde Dilatation of Inflammatory Rectal Strictures. By DR. VICTOR LIEBLEIN (Prag). **II. Exclusion in the Treatment of Rectal Strictures.** By DR. HERMANN SCHLOFFER (Prag). The former procedure is applicable to such rectal stenoses non-malignant in character which are impervious to bougies introduced from the anus. Before any extensive resection for impervious stricture is undertaken an artificial anus is made. The bougie is guided into the stricture by placing

into the descending loop a fillet of silk with a shot attached to one end, the free end being held out on the abdomen. The peristalsis of the bowel expels the shot with silk attached to it. To the free end of the silk fillet larger and larger bougies are successively attached and guided into the stricture by traction on the thread at the anus. When dilatation of the stricture has proceeded so far that passing of bougies from the anus is feasible, attempts at retrograde dilatation are no longer persisted in.

The advantages of this procedure are the avoidance of false passages, the practicability of leaving the bougie longer in the grasp of the stenosis, thereby hastening dilatation.

In one of the instances where the above procedure failed to effect a permanent cure, the method of intestinal exclusion was resorted to. The sigmoid flexure was made to anastomose with the rectum below the level of the stenosis. The anastomosis was done with the Murphy button, but the orifice between the rectum and sigmoid subsequently contracted, but was much easier of dilatation by the introduction of the finger from the anus.—*Beiträge zur klinischen Chirurgie*, Band xxxi, Heft 3.

MARTIN W. WARE (New York).

EXTREMITIES.

I. A New Method of Reducing Dislocations of the Shoulder. By DR. F. HOFMEISTER (Tübingen). The principle of this method consists in the application of a systematic permanent extension of the upper extremity by weights. The incentive to this procedure emanated from Stimson's plan to place the patient in a hammock and allow the arm to pass through a hole in the hammock, and by attaching weights, eight to twelve pounds, to the dependent arm, a reduction is accomplished within four to six minutes. The author finds this method efficient, yet enumerates as drawbacks the great pressure exerted on the axilla by the hole in the hammock, which tends to increase the venous stasis favored so strongly by the dependent position of the arm. Both

of these factors tend to make this method painful, and, finally, a bulky apparatus (?) operates against a general use of this method of Stimson. These disadvantages the author claims to have offset by his method. The patient is comfortably placed on his sound side. Extension straps are then applied to the arm of the affected side, as high up as the deltoid insertion, and secured with a roller bandage tightly applied, to prevent sliding of soft parts on the bone. A rope, connected with the straps, is guided over a set of pulleys attached to the end of a rod. The rod is raised to a sufficient height to permit of full extension of the arm. Ten pounds are first fastened to the free end of the cord, and at intervals of five minutes additional ten pounds are added until forty pounds are reached. Five to fifteen minutes' action of this force suffices to effect a reduction, which may set in sooner sometimes. Once the reduction set in after two minutes. A dislocation of two weeks' standing was reduced with forty pounds weight in forty-five minutes. In four instances reduction was hastened, as soon as the head of humerus was on margin of the glenoid, by drawing the head towards the acromion process, removal of the weights, and slowly adducting the arm. The latter procedure is eminently proper even after perfect reduction, since bringing the arm from complete extension to the side of the chest in careless fashion may result in a dislocation. Seven times this method was employed in each instance successfully. The constant moderate traction of the weights overcomes the contraction of the muscles. The avoidance of a narcosis, the relative simplicity (?) of the technique, and its absolute harmlessness are advantages which may make this method more popular among practitioners than the manipulative procedures of Kocher.—*Beiträge zur klinischen Chirurgie,* Band xxx, Heft 2.

II. Congenital Dislocation of the Scapula. By Dr. Wilhelm Rager (Copenhagen). The preliminary remarks cover the author's narrative of three cases. Two of the cases showed other congenital defects: congenital hernia and adenoid vegeta-

tions. Aside from the dislocation, there were found alterations of the scapula in both instances and defective formation of the upper dorsal vertebræ (X-ray); in both instances there is a neurotic family taint. All these factors contribute to a neurotic basis (defect) of this deformity. Together with his own cases, and including the four original cases of Sprengel, the author has collected thirty unilateral and two bilateral cases. The left scapula is most frequently affected, sixteen times, the right eight. The analysis tends to show that the cases are not all of the same class, wherefore the following classification is offered:

Group I embraces cases with a change of axis of scapula, prominence of superior angle of scapula in supraclavicular fossa, with ligamentous or cartilaginous union with the spine; scoliosis of slight degree.

Group II has no instances of deviation of axis of scapula, but all other features.

Group III comprises instances of marked bony deformities extending from the atlas to the scapula.

Group IV refers to dislocations of scapula towards or from median line with associated trophic disturbances.

Etiologically, all the factors that have been credited to congenital dislocation of the hip are also held responsible for this. Prognosis is bad as far as cure of deformity is concerned, but the elevation of the scapula does not become aggravated with growth. —*Zeitschrift für Orthopädische Chirurgie,* Band ix, Heft 1.

MARTIN W. WARE (New York).

REVIEWS OF BOOKS.

THE EYE, EAR, NOSE, AND THROAT. Vol. III of The Practical Medicine Series of Year Books. Edited by CASEY A. WOOD, C.M., M.D., ALBERT H. ANDREWS, M.D., T. MELVILLE HARDIE, A.M., M.D. The Year Book Publisher, Chicago, December, 1901.

The present work apparently does not aim to cover the entire year's progress in the sciences of which it treats. It is more nearly a *résumé* of new clinical suggestions and advances in therapeutics of the diseases consecutively brought to notice. It is lightly edited, the words of the authors whose articles are reviewed being largely transferred to the text. This is only commendable in that it leaves the original author responsible for personal views expressed. The cuts incorporated likewise carry the original author's personal imprint without particular comment from the editors. The culling of extracts has been carried out widely rather than deeply, and in this we commend the authors. Many of the special articles that are scattered through the general medical literature of this and other countries are never seen by the specialist, and thus some really valuable hints and notes of cases are lost to him. We do not mean to say that the special journals have been ignored by the editors, but the line has to be drawn in a book of moderate size, and hence the editors have wisely chosen papers of a general interest, though some of them do not bear the stamp of most profound experience. Thus the book occupies a place, as it was doubtless planned that it should, midway between the weekly or monthly journal and the text-book of the matured author.

Most of the best papers of the year have been rather fully presented; others, with little pretence to originality, or contain-

ing only "rediscoveries," have necessarily been included. But by repetitions we advance, so that what is merely ephemeral must be culled into a work necessarily of somewhat evanescing value.

WILLIAM C. BRAISLIN.

FIRST AID TO THE INJURED AND SICK. An Ambulance Handbook. By F. J. WARWICK, M. B. CANTAB, M.R.C.S. and A. C. TUNSTALL, M.D., F.R.C.S., Ed. 12mo.; pp. xvi, 232; 205 illustrations. Philadelphia: W. B. Saunders & Co., 1901.

This new candidate for the favor of first-aid classes has many excellent features. Its first part takes up human anatomy and physiology with unusual elaboration in books of its class, beginning with the cell and closing with the sympathetic nervous system. The second part opens with a chapter on bandaging, which is treated more elaborately than in many professional works upon the subject, both the triangular and roller bandages being considered in great detail and with profuse illustration. Much space is devoted to hæmorrhage, as would be expected from the particular amenability of emergencies involving it, to relief by first aid. No new methods of controlling hæmorrhage are brought out, but a series of new plates showing the control of bleeding from the principal arteries is of value, and a new tabular presentation of the subject is excellent, although perhaps a trifle elaborate. The chapter on wounds is not as full as most of the other chapters, and might have been amplified with advantage. The page headings of the chapter, which is devoted mainly to fractures, read "The Immediate Treatment of Sprains, Etc.," which is rather misleading in a portion of the book treating excellently and lucidly of broken bones. The discussion of the subject of transportation is essentially English, and omits many of what we in the United States are inclined to consider important improvements; the methods of lifting and carrying by a single bearer are particularly deficient in this respect. The Ames Board for transportation of the disabled on shipboard, in mines, etc., is a useful American substitute of the Lowmoor Jacket, and the Kirker "Ambulance

Sleigh" is a valuable English appliance for the same purpose. An excellent chapter on "Preparation for the Reception of a Case of Accident or Sudden Illness" closes a valuable and useful work.

JAMES EVELYN PILCHER.

THE DIAGNOSTICS OF INTERNAL MEDICINE. By GLENTWORTH REEVE BUTLER, A.M., M.D., Chief of the Second Medical Division, Methodist Episcopal Hospital, etc.; 1087 pages, with five colored plates and 246 illustrations and charts. New York: D. Appleton & Co., 1901.

This book is admirable in arrangement, very attractive in its exceptional illustrations and typography, and presents a great catalogue of facts in a manner which permits of their ready selection and use. Its practical character, combined with a profusion of illustrations and diagrams, simplifies and lends interest to a subject which is often difficult and abstract. The book will prove useful most of all to the general practitioner, for diagnosis still remains his weakest point. Good works upon this subject, therefore, occupy an important place in medical literature, especially where, as in the present instance, they assist in the formation of systematic methods of diagnosis, and the orderly mental grouping of related facts. The surgeon, too, finds works on medical diagnosis essential; for although he may relegate the treatment of medical diseases entirely to the medical practitioner, he must himself be able to readily distinguish between affections requiring medical and those requiring surgical aid, and be familiar with the clinical methods necessary in making such distinctions.

The present work is arranged in two parts, on a plan original with the author. Part I comprises, under the heading "The Evidences of Disease," the clinical anatomy and physiology of organs and systems; the best methods of clinical examinations; the signs and symptoms encountered in the practice of internal medicine; and the consideration of the diagnostic significance of each sign and symptom. Part II, under the caption "Diagnosis, Direct and Differential," comprises descrip-

tions of recognized diseases and their symptoms, with special reference to the diagnosis of each disease. The two parts of the work are complementary, and used together, are designed to contain all that is essential for the making of a diagnosis in any particular instance.

Part I forms the larger part of the work, and makes up a general symptomatology, with discussion of all sides of the various evidences of disease. The author insists upon a thorough knowledge of clinical methods as the basis of the art of diagnosis, and in this section of the book gives complete descriptions of laboratory methods as well as those for use at the bedside. Fine original illustrations, many of them in colors, embellish this part of the work, aiding greatly in a quick grasp of the matter under discussion. Ingenious diagrams and charts are frequently used, which leave in the mind a clear picture of the lines and limits of physical signs, and make lucid the complicated phenomena of the nervous mechanism. The sections on pain, and the abdomen and viscera, are of as much interest to the surgeon as to the physician.

The second part of the work contains the special symptomatology of individual diseases, with reference to their direct and differential diagnosis. Pathology, etiology, and prognosis are also considered, but in a necessarily cursory manner, making a fairly complete picture of each particular ailment, thus adding to the practical character of the book and its value as a work of ready reference to the practitioner. After tracing some particular symptom in Part I, the reader finds mentioned there the diseases in which it occurs. Then turning to the symptom-groups of those diseases in Part II, he may compare his case, and reach his diagnosis in a logical sequence, well to be followed habitually in practice.

On the whole, this volume may be considered the best of its kind in the language. It represents in a very complete and scientific manner the sum of our present-day knowledge in the diagnostics of internal medicine. Its attractive style and artistic merits add considerably to its value, for such works should find favor with all classes of practitioners, and invite to their frequent use. The fact

that a second edition of the work is already required is not only a high compliment to the author, but to the desire on the part of the profession to do better work in diagnosis.

RICHARD W. WESTBROOK.

ENCYKLOPÄDIE DER GESAMMTEN CHIRURGIE. Edited by THEODORE KOCHER, of Bern, and F. DE QUERVAIN, of La Chaux-de-Fonds. In twenty-five parts. F. C. W. VOGEL, Leipzig, 1901; G. E. STECHERT, New York, Agents.

The name of Theodore Kocher at the head of a work of this kind is sufficient recommendation to everybody interested in the higher problems of surgery.

The scope of the work is the entire field of surgery in its broadest sense, and overlaps the kindred branches of medicine, especially materia medica, anatomy, and pathology.

The work follows the same general plan as the "Reference Hand-book of Medical Science," and in its field is thorough and complete. The articles are all signed, and the list of contributors includes a hundred and fifty or more of the leading surgeons of Germany, Austria, and Switzerland.

A glance over the first part of the work shows a long list of subjects, some familiar, some unfamiliar, and some previously unheard of. Among the more important contributions may be mentioned the following: Appendicitis, by Roux; Antisepsis, by Winiwater; Hernia, by Schmidt, of Heidelberg; Apoplexy, by Tilmann.

The work will prove an inexhaustible source of information for one interested in either the theory or practice of surgery.

GEORGE R. WHITE.

COPIES of the January, 1902, ANNALS OF SURGERY are wanted by the publishers. Subscribers having copies to dispose of will kindly communicate with the publishers.

J. B. LIPPINCOTT CO.

ON THE AVOIDANCE OF SHOCK IN MAJOR AMPUTATIONS BY COCAINIZATION OF LARGE NERVE-TRUNKS PRELIMINARY TO THEIR DIVISION.

WITH OBSERVATIONS ON BLOOD-PRESSURE CHANGES IN SURGICAL CASES.[1]

By HARVEY CUSHING, M.D.,

OF BALTIMORE,

ASSOCIATE IN SURGERY, THE JOHNS HOPKINS HOSPITAL.

(1) By common usage the term "shock" has come to represent a peculiar state of depression of the normal activities of the central nervous system. Such a condition is ordinarily brought about by traumatism, of one sort or another, to peripheral afferent nerves. In order to produce shock, the impulses resulting from this traumatism must have acted reflexly upon the vasomotor mechanism in the medulla in such a way as to occasion a marked fall in blood-pressure. This diminution of arterial tension is the most characteristic symptom of shock.

(2) Under ordinary circumstances injuries of only moderate severity to peripheral nerves cause a rise in blood-pressure. If, on the other hand, these injuries are extensive or frequently repeated, or if they are complicated by certain primary or secondary anæmias, they are commonly productive of a fall in blood-pressure, indicating a state of shock.

Shock consequently need not be occasioned even in most extensive surgical procedures on the extremities, provided due regard is given to perfect hæmostasis. In operations of considerable magnitude, however, during which the division of many large nerve-trunks becomes necessary, or in operating upon such

[1] Being the basis of the Address in Surgery before the Wisconsin State Medical Society, June 4, 1902.

traumatic cases as have been already complicated by extensive injury to peripheral sensory nerves, so-called operative shock is rarely avoided.

When, therefore, any condition is existent which predisposes to shock, such as loss of blood, prolonged anæsthesia, etc., or when a certain degree of shock is already present before operation, especial risk is attendant upon the division of important sensory nerve-trunks.

(3) Cocaine injected into a nerve-trunk effectually blocks the transmission of all centripetal or sensory impulses. Cocainization, therefore, of main trunks of nerves central to the proposed site of their division in a major amputation, prevents the conduction of those impulses resulting from the traumatic insult which otherwise, by acting reflexly through the medullary centres, might become the chief factors in the production of shock.

Three years ago, during the progress of an interscapulothoracic amputation for a metastatic sarcoma of the shoulder and before the principles laid down in the foregoing introductory paragraphs were sufficiently appreciated, it was the writer's misfortune to have occasioned a profound and almost fatal condition of shock by the division of the brachial plexus of nerves. This case and a subsequent one of ablation of the entire upper extremity, in which precautions of anæsthetization of the plexus before its division were observed, illustrate so well from the clinical side the principles which will be emphasized in this communication that they will be briefly summarized.

CASE I.—(Surgical Number 9803.) *Ablation of Breast, Upper Extremity and Shoulder-Girdle for Sarcoma. Profound Operative Shock in Consequence.*

Miss A., forty-one years of age, entered the hospital, December 22, 1899. A pigmented cutaneous mole had been removed from the left forearm two years before her admission. In May, 1899, following an injury to her left shoulder, a secondary growth appeared in the axilla, which increased slowly in size up to the past few weeks. This has enlarged very rapidly of late, and a mass of glands has appeared above the clavicle.

FIG. 1.—Case I. Showing axillary tumor and œdematous extremity before operation.

FIG. 2.—Case I. Twelve days after operation.

During this period of rapid growth of the axillary tumor the pain in the arm has become so severe that large doses of morphine have been necessary to control it. The patient has lost greatly in strength and weight from pain and sleeplessness. The pain evidently is occasioned by pressure on the brachial plexus, and is referred over its entire sensory distribution from shoulder to finger-tips.

Physical examination showed a large, fleshy woman, apparently suffering acutely, holding her left arm abducted forty-five degrees from her side in order to avoid pressure against a large axillary tumor the size of her head (Fig. 1). This growth extended from the clavicle almost to the nipple and from the parasternal line to the outer border of the scapula. The tumor seemed to be attached to the chest wall, and attempts to move the arm or the growth caused severe radiating pains. It imparted a sensation of pseudofluctuation, and the skin which was thinned over it was covered with dilated venules. The entire arm was œdematous and the hand slightly cyanosed. The tumor measured sixty-seven centimetres in its partially exposed circumference. The metastatic growth above the clavicle, the size of a hen's egg, was firmly adherent to the neighboring structures and caused pain when it was handled. The case seemed most unpromising, but was undertaken in the hope of relieving the patient's suffering by division of the brachial plexus should it be found impossible to do a complete operation.

Operation, December 26, 1899. Ether anæsthesia. An incision, starting just below the mastoid process, was carried downward across the clavicle and along the inner margin of the breast. The clavicle was exposed and divided with a Gigli saw. The axillary artery and then the vein were ligated and divided. The tumor with the breast, pectoral muscles and arm were then turned outward and the growth fortunately found to be unattached to the thorax. The operation up to this point was without incident; practically no blood had been lost, and the only remaining step was the completion of the scapular part of the amputation.

As the tumor with the breast, arm, and clavicle dropped away from the chest wall, the brachial plexus was exposed and the nerve-trunks under some tension were divided with a few strokes of the knife. It was necessary to pick up with clamps the central bleeding ends of a few of these nerve-trunks. Immediately the

patient's pulse jumped from 110, which represented its "ether level," to 150, where it remained until the shoulder amputation was completed.

The mass of glands in the neck had been freely exposed by the high incision and was readily enucleated. Several large branches of the plexus, however, were spread out over this growth, and a secondary division of this portion of the plexus consequently was necessitated. When this was done, the patient's radial pulse immediately became impalpable (see accompanying chart, Fig. 4). It continued thready and almost imperceptible during the remainder of the operation, which was rapidly completed, and for almost twenty-four hours afterwards. During this postoperative period the patient's general condition closely resembled that seen in cases of shock such as accompany serious traumatic crushes of an extremity.

The patient finally made a complete recovery. The wound healed by primary union throughout (Fig. 2). The size of the tumor in comparison with the arm is shown in the photograph (Fig. 3). It was a round-celled sarcoma.

It doubtless has come within the experience of most operators to see patients brought into a profound condition of shock before the termination of major amputations of this nature. It is, however, unusual to be able so definitely to attribute to one particular step the exact occasion of the upset to the vasomotor and cardiac mechanism. For some years it has been our custom to have the anæsthetist plot a so-called "ether chart," which records the variations in pulse-rate during the period of narcosis. Such charts were, I believe, first introduced by Dr. Codman for use in the Massachusetts General Hospital, and very valuable data as to the patient's condition may be obtained therefrom. The pulse-rate, however, thus graphically represented during an operation, may give no real indication of the degree of actual or impending shock for the true estimation of which observations upon the blood-pressure are necessary. It must be borne in mind that a pronounced rise or fall in arterial tension may be unassociated with any change in pulse-rate. However, a persistent increase in the rapidity of the pulse in cases in which loss of blood has been

FIG. 3.—Case I. Showing size of tumor mass in comparison with œdematous arm.

slight may be taken as in a measure indicative of a corresponding fall in blood-pressure, and so representative of the degree of shock. The accompanying chart (Fig. 4) represents the pulse-rate as plotted during the operation upon this particular case, and shows by the marked alteration in its rapidity the reflex effect upon the neurovascular mechanism which was produced by the division of the brachial plexus in each instance as described.

The following case, one of similar nature and in which

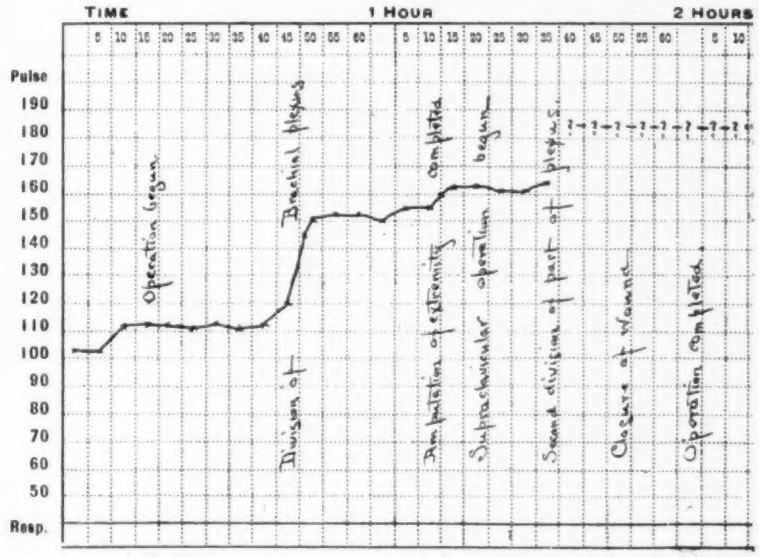

FIG. 4.—Chart recording pulse-rate during operation on Case I, December 26, 1899.

the same operative procedure was carried out, illustrates how the disturbing effects of nerve section observed in Case I might have been avoided.

CASE II.—(Surgical Number 9828.) *Large Sarcoma of Upper End of Humerus with Pathological Fracture. Interscapulo-thoracic Amputation. Cocainization of Brachial Plexus and without Production of Shock.*

J. E., thirty-two years of age, entered the hospital, January 11, 1900. The patient had had pain of supposed "rheumatic"

nature in the left shoulder for four years. Following an injury, which occurred six months before his admission to the hospital and which was associated with severe contusion of the shoulder, the pain increased, and a short time later the present tumor began to be evident. During the past two or three months the growth has increased rapidly in size (Figs. 5 and 6).

The patient was in good physical condition in spite of his suffering, which was considerable and had been constant for four months. The character of the tumor is better shown by the photographs than by a description. A pathological fracture was present in the centre of the growth, and the slightest motion of the arm was forbidden. The entire arm was œdematous and cyanotic, and neurotrophic disturbances were evident in the fingers and hand. The tumor measured sixty-six centimetres in circumference.

Operation, January 2, 1900. Ether anæsthesia. The entire left half of the shoulder-girdle with the arm was removed in the usual way. On account of the inaccessibility of the subclavian vessels from the encroachment of the tumor upon the operative field, it was easier to divide the vein before the artery. This was done, though it was doubtless an error in judgment and a procedure which occasioned the loss of considerable blood into the extremity. Nevertheless, after preliminary cocainization of the brachial plexus, the bundle of nerves was severed; the extremity with clavicle and scapula was removed, the dry wound closed without drainage, and no shock resulted from the operation. The patient was up the following day; began rapidly to gain in weight; the wound healed by primary union (Fig. 7). He was discharged on the fourteenth day, and has since been actively engaged in his former occupation of farming. Fig. 8 shows a section of the tumor in illustration of the extensive destruction of the humerus. The tumor proved to be a medullary sarcoma.

However much alike, as in these two cases, individual conditions may seem to be, it is impossible to say that the same physiological response on the part of the central nervous system would follow in each instance a given insult to peripheral sensory nerves. As will be emphasized hereafter, the same afferent impulses may, under certain circumstances, determine reflexly a rise in blood-pressure from augmentation

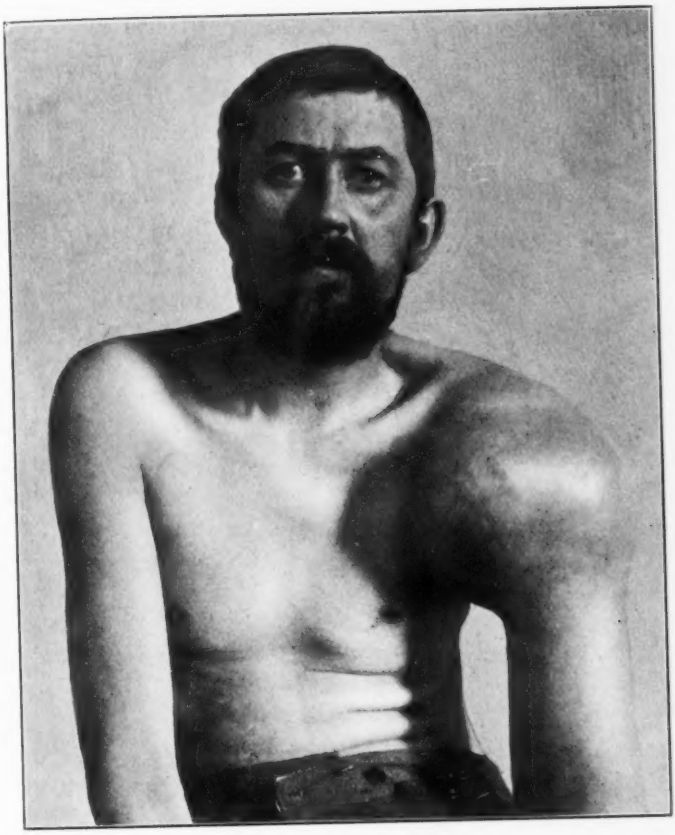

FIG. 5.—Case II. Tumor and œdematous extremity before operation.

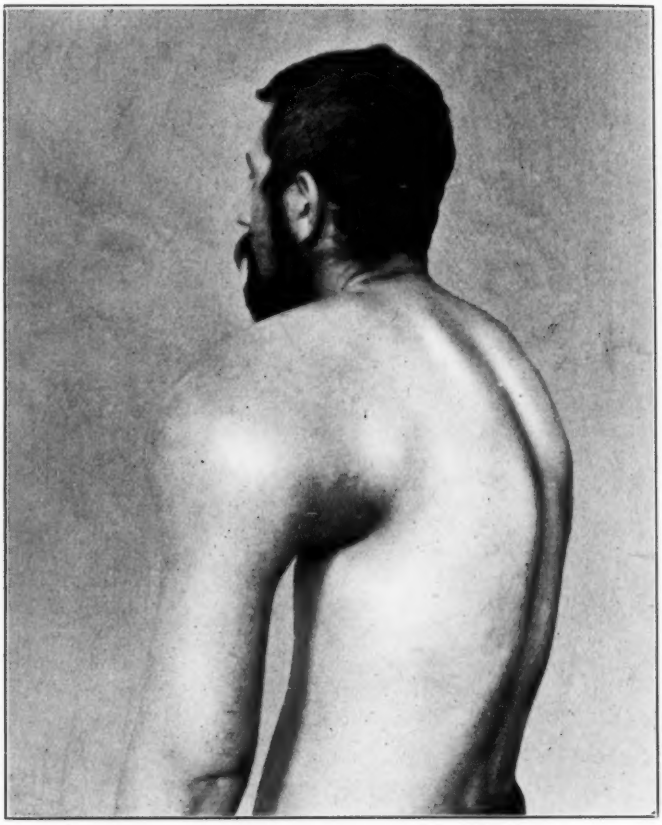

Fig. 6.—Case II. Posterior view.

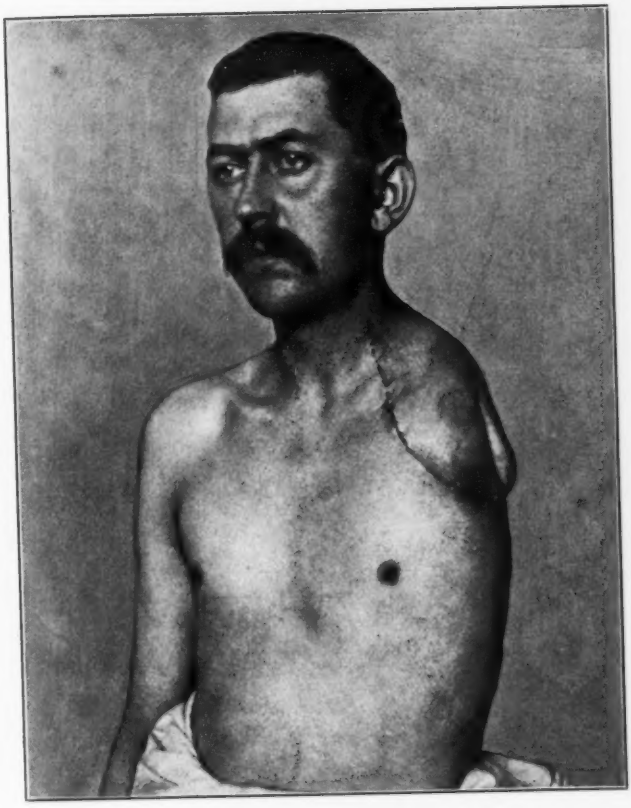

FIG. 7.—Case II. Ten days after operation.

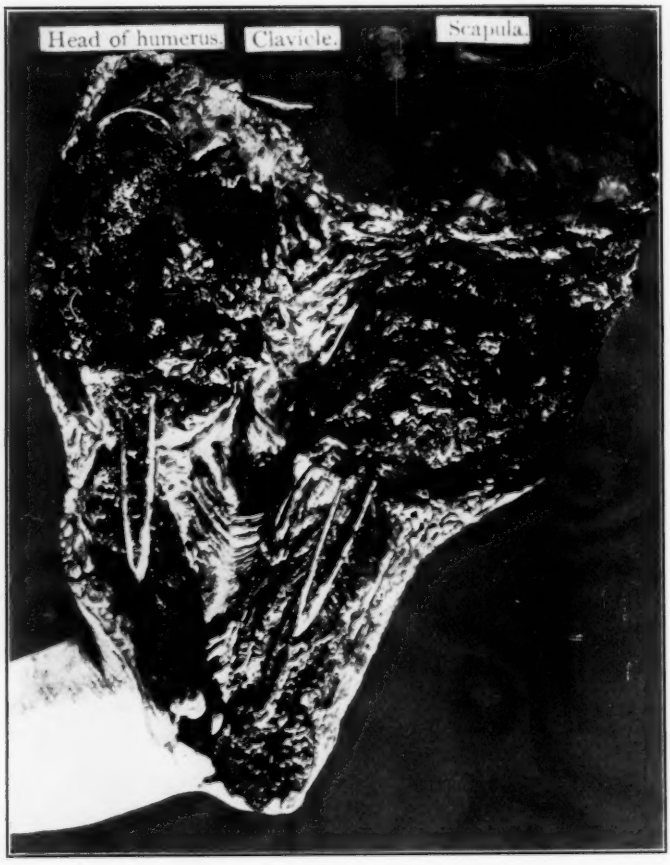

FIG. 8.—Case II. Photograph of section of very soft, diffluent tumor, receiving large amount of hæmorrhage into it and organizing blood-clot, accounting for rapid growth. Very little new bone formation.

of vasoconstrictor action, which under other indefinable circumstances might determine a fall, from diminution of the same. These two patients, however, presenting as they did such close similarity in clinical condition, and subjected as they were to an operative procedure of such close correspondence, may, for the sake at least of pointing a moral, be considered to have stood upon the same physiological level.

It can be seen by consulting the "ether chart" (Fig. 9)

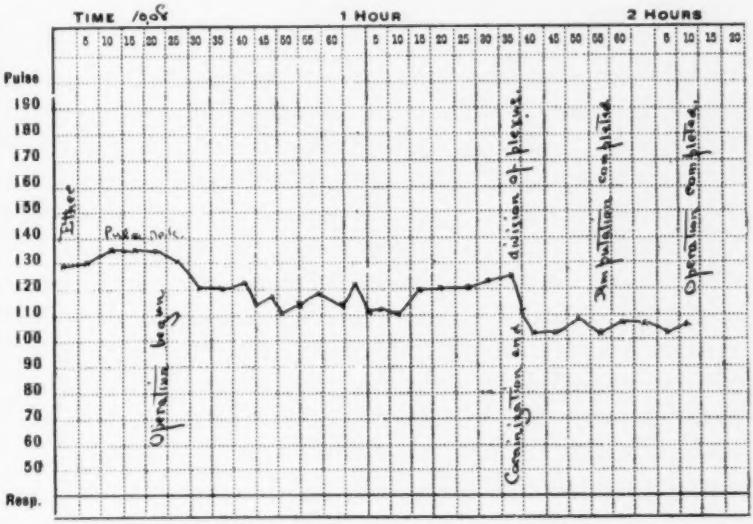

FIG. 9.—Ether chart recording pulse-rate kept during the operation on Case II.

kept during the operation on this second case that at the moment of cocainization and subsequent division of the plexus there was an associated retardation in pulse-rate from 120 to 102 beats per minute. The slight increase in cardiac activity which preceded this division for ten or fifteen minutes doubtless was due to the dragging upon the nerve-trunks brought about by the weight of the hanging extremity and shoulder. Such an acceleration of cardiac rhythm accompanying a reflex pressor effect is the normal response to such a stretching of peripheral mixed nerves. On repeating this operation on animals, I have seen this early pressor effect

followed, after crushing the plexus with forceps and dividing it, by a marked fall in blood-pressure, recovery from which might or might not take place, depending on the previous condition of the animal.

Although an interscapulo-thoracic amputation may be regarded as an operation of considerable magnitude, it should be a comparatively bloodless performance, and the wide experience at this hospital with an operative procedure of possibly greater extent, carried on in a neighboring situation and one which demands a greater amount of time for its performance, namely, the complete Halsted operation for carcinoma of the breast, has shown that a condition of shock rarely supervenes, provided that principles of absolute hæmostasis have been carefully observed. In illustration of this and for comparison with the ether charts which accompany the first two cases, a representative chart of the type of those which are plotted during this extensive operation is here reproduced (Fig. 15). In this procedure the chest wall is completely bared of both pectoral muscles; the entire axillary contents are removed, leaving exposed the axillary artery, vein, and brachial plexus; the contents of the supraclavicular triangle furthermore are often removed, laying bare the vessels and brachial plexus a second time in the neck. Although this is one of the most extensive operations of the present day surgery, provided there is no loss of blood, shock need rarely, if ever, be occasioned. This is undoubtedly due not only to the perfect control of hæmorrhage, but to the fact that no large or important sensory nerve-trunks are divided or injured. In operative cases, however, in which it becomes necessary to divide large bundles of nerves, precautions other than the avoidance of the loss of blood seem to be demanded.

Dr. George Crile, in his recent admirable monograph ("Problems Relating to Surgical Operations," Philadelphia, 1901, p. 157), has once more laid emphasis upon the physiological blocking effect of cocaine when injected into peripheral nerves, and much of the credit of the considerable employment of such a procedure in the prevention of shock has been the

result of his interesting experimental work. The same principle of "blocking" nerve-trunks has been utilized for a long time as a means of producing anæsthesia over proposed operative fields by thus throwing out of function the sensory nerves radiating from it. I would suggest that this be called "regional anæsthesia" in contradistinction to "local anæsthesia." Thus, operations for hernia, amputations of an extremity and the like, may be painlessly performed. Dr. Crile reports a case of interscapulo-thoracic amputation in which cocainization of the brachial plexus sufficed for the accomplishment of the operation. In this way risks of general narcosis were avoided as well as any likelihood of shock, and the blocking subserved the double function of giving an analgesic field for operation and of preventing central disturbances from inflowing impulses.

Unfortunately, in this particular procedure the skin incision must pass through non-anæsthetized territories supplied by cutaneous nerves of thoracic segments. These areas necessarily must be individually cocainized,—a difficult performance, and one requiring an accurate knowledge of segmental distribution. Similarly, cocainization of the sciatic nerve to produce "regional anæsthesia" for amputation of the leg below the knee does not in itself suffice for a painless operation. In the two instances in which I have so operated, care has been taken to anæsthetize locally, along the line of proposed incision, the territory supplied by the long saphenous nerve. It is worthy of note, also, that this nerve supplies the periosteum over the inner surface of the tibia which must also be cocainized. These two operations were performed for gangrene of the extremity in old people in whom general narcosis seemed to be contraindicated.

Such operations under local or regional anæsthesia are at best more difficult than corresponding ones carried out under general narcosis, and few operators seem able or will take the time to perform them satisfactorily. The blocking of nerves before division during operations under complete anæsthesia, however, is another matter, and is only related,

through the physiological principle involved, to these operative procedures under regional anæsthesia in which the sensory nerves supplying the operative field have been cocainized.[1]

It will be recognized immediately by operators that the surgical principles here upheld preclude the possibility of employing the time-honored methods of amputating, which, it must be confessed, are more or less a relic of the spectacular days of surgery. Operations of the sort described above are undoubtedly carried out with far greater security by the method of dry, painstaking dissection, which is now employed in most surgical clinics for practically all major amputations. The tourniquet and long amputating-knives are practically relegated to disuse. The peripheral vasodilatation which follows the removal of a tourniquet occasions the loss of blood, is an embarrassment during the closure of a large amputation wound, and usually necessitates drainage. The use of pins and other appliances for the purpose of skewering the vessels in high amputations only adds difficulties to what otherwise is a comparatively simple procedure of dissection. On the two occasions in which I have amputated at the hip with primary ligation of the external iliac vessel, with careful observance

[1] The physiological principle involved in this discussion covers only the blocking effects of cocainization of peripheral sensory neurones for purposes of "regionary anæsthesia," or for the avoidance of shock during general narcosis. Cocainization of the spinal cord by a subarachnoid lumbar injection, with blocking, possibly, of a higher order of neurones, is quite another thing. Here a different physiological effect comes into play in consequence of the throwing out of action in the majority of cases of the vasomotor fibres passing from the upper thoracic segments to control the splanchnic system. As a result, there is a flooding of this territory. Shock consequently, in so far as it is an expression of low blood-pressure, is almost without exception produced, not avoided. This I believe to be the real source of danger in "rhachicocainization," and not the toxic effects of the drug itself. In my estimation, it is a performance invariably attended by considerable risk on account of this associated fall in blood-pressure. Unfortunately, the enthusiasm which followed Bier's original proposition swept many an operator along with it, a result which the originator himself deeply regrets. ("Weitere Mitteilungen über Rückenmarksanästhesie." *Verhandlungen der deutschen Gesellschaft für Chirurgie*, Band 1, S. 171, 1901.)

FIG. 10.—Ten days after amputation of thigh by dissecting method, showing configuration of innominate bone covered by little more than skin flap.

of complete hæmostasis during the dissection and with cocainization of the anterior crural and sciatic nerves before their division, there was no indication of even a temporary reflex effect upon the blood-pressure or cardioregulatory centres. No drainage, of course, is required in case such a method is employed. One of these amputations was carried out on a greatly prostrated young man suffering from a recurrent sarcoma of the thigh, an amputation of the leg lower down having been performed a short time before. In this case the amputation was of necessity made very close to the innominate bone, so that practically nothing was left to cover the wound but a flap of skin saved from the gluteal region (Fig. 10).

Should the tourniquet be used in amputations, I believe that its application distal to the site of amputation has more *rationale* than the usual proximal method of employing it. It may thus be applied as an Esmarch bandage either after the ligation of the main arterial vessel or before beginning the operation, its purpose being to prevent the loss of blood into the extremity. Such a filling up with blood otherwise not only follows the ligation of the chief venous radicle, but also the division of nerves to the member, since their section causes a flushing of the territory from local vasomotor paralysis. This flushing, however, occurs distal to the site of operation not in the stump itself, as when the tourniquet is applied proximally. The carrying of such an Esmarch bandage over the area occupied by a new growth of course should be avoided under any circumstances.

To major amputations for traumatic injuries of the extremities do these principles apply in degree almost greater than in pathological cases. Here a state of shock may already be present, and the attendant ordinarily is advised to wait for some hours, during which time a readjustment of conditions is expected to take place and the severity of shock to diminish. As a matter of fact, the very conditions are present which tend to perpetuate or to increase the already existent degree of shock. Such an increase is brought about by a continuation of afferent sensory impulses. The tourni-

quet itself, which has been applied at the time of the accident, although controlling the loss of blood, constantly adds, from pain, an increment to the shock of the original injury. The dragging of the helpless or mangled limb on the great sensory nerve-trunks, which are rarely severed, gives impulses of pain with every movement of the often restless patient,—impulses which in such a state cause reflexly a further lowering of blood-pressure. Strychnine, intravenous infusion, even though there may have been but slight loss of blood, and delay, are the usual measures advocated for such states. I believe they are, if not actually harmful, certainly not helpful. The real indication is to rid the patient of the centripetal impulses, originating in the crushed member, by cocainization and division of the large nerves, so often exposed in a mangled limb, by ligation of vessels if necessary, and the earliest possible removal of the painful tourniquet. Under proper management, with possible strapping of the abdomen to hold up the blood-pressure, with morphine in small amounts to control restlessness, and with a proper avoidance of those conditions which during the operation would increase shock, I believe that it is no heresy to advocate ether anæsthesia (never chloroform) and early operation for most cases of severe traumatism of the extremities.[2]

[2] I am rather inclined to believe that the reason why delay has come to be so universally advocated in severe cases of traumatic shock is because in the course of some hours time itself will pick out those cases which are favorable ones for operation. The border cases and the unfavorable ones grow worse from the start, and finally are abandoned as unfit for interference. Thus the results in case of delay must of necessity from a statistical stand-point be much the better. It is very much the same thing as waiting for the effects of so-called shock to pass away in cases of intestinal perforation. Here, also, delay suffices to select those cases favorable for operation. Those which progressively go down hill and do not rally are finally regarded as unfit for operation. It is the border-line case which early intervention, carried out under proper principles, may succeed in saving. I have recently seen a case of typhoid perforation in collapse improve on the operating-table during a cocaine operation, the patient's arterial tension measuring considerably higher after the closure of the wound than before the operation, no stimulants whatever having been used. Similarly in the border-line cases of trau-

Unfortunately, at the time when these two cases which I have cited were operated upon, observations upon blood-pressure, the estimation of which is much more important than the pulse-rate, could only be guessed at through the medium of a palpating finger on a peripheral artery. Although the importance of an educated touch is by no means to be belittled, it is nevertheless desirable on all important occasions to supplement tactile observation, where possible, by the data obtainable from some instrument of precision. The clinician is not satisfied, as of old, with an estimation of temperature gained by placing the hand on a patient's forehead nor by a guess at the pulse-rate, especially when comparative alterations from moment to moment are of value. That figures giving us accurate data concerning variations in arterial tension are even more desirable needs no comment. This is especially true if we wish to study intelligently the condition of shock in our traumatic and operative cases for the purpose of properly estimating its degree, its alterations, whether increasing or diminishing, the effect produced upon it by various steps of our operative procedures, and the true influence which the usually prescribed therapeutic measures have upon its course.

At the present time, happily, a simple and convenient "blood-pressure" apparatus has been introduced into the clinic, a form adapted from that described by Riva Rocci. By means of this apparatus, alterations in arterial tension may be taken during an operation with the shortest possible interval, and the figures representing millimetres of mercury immediately charted. Thus an operating surgeon may obtain, graphically represented, data concerning the patient's condition in almost exact correspondence with that which the physiologist gains

matic shock I believe that the prompt removal of conditions tending towards its perpetuation will save cases swaying in the balance which otherwise must go to the ground. Should a general anæsthetic be required, ether should be selected. Chloroform, owing to the fall in blood-pressure which accompanies its administration even in normal states, is of course absolutely contraindicated.

during an experiment by having an animal's carotid in connection with a mercury manometer whose level is constantly being recorded on a revolving drum.

By means of information obtained by this apparatus in the operating-room during the past six months, on several occasions in critical cases, have we been able to anticipate and to avoid profound states of shock and collapse, and indeed, in some instances, I feel confident that it has been instrumental in saving lives.

A study of these cases in which comparative curves of pulse-rate and blood-pressure have been kept during operative procedures is being made by Dr. Briggs, who will report upon them later, with especial reference to the therapy of shock. Unfortunately, for purposes of comparison, no interscapulothoracic amputations of the sort described above have been performed since the inauguration of these blood-pressure records.

A few examples, however, from Dr. Briggs's collection will be reproduced here in illustration of the way in which the physiological effects of operative procedures on the pulse and blood-pressure may be plotted in some conformity with the more familiar charts made during laboratory experimentation. Of these illustrative charts three have been selected from the groups comprising the abdominal and cerebral cases. One or two reproductions of charts showing the blood-pressure responses in peripheral operations, with which group of cases this communication more particularly deals, are also given.

CHART I.—(Fig. 11.) *Abdominal Group. Visceral exposure for tuberculous peritonitis.* Shows the depressor effect brought about during an intra-abdominal exploration by exposure and handling of the viscera. This fall in blood-pressure, which might have become perpetuated as a condition of shock, was rapidly recovered from, after a hurried closure of the wound, by the application of a tight abdominal binder, which gave support to the relaxed splanchnic vessels. In such cases the vascular relaxation is probably due to direct insult to the splanchnic

end of the neurovascular mechanism and not to a reflex action such as peripheral injury occasions.

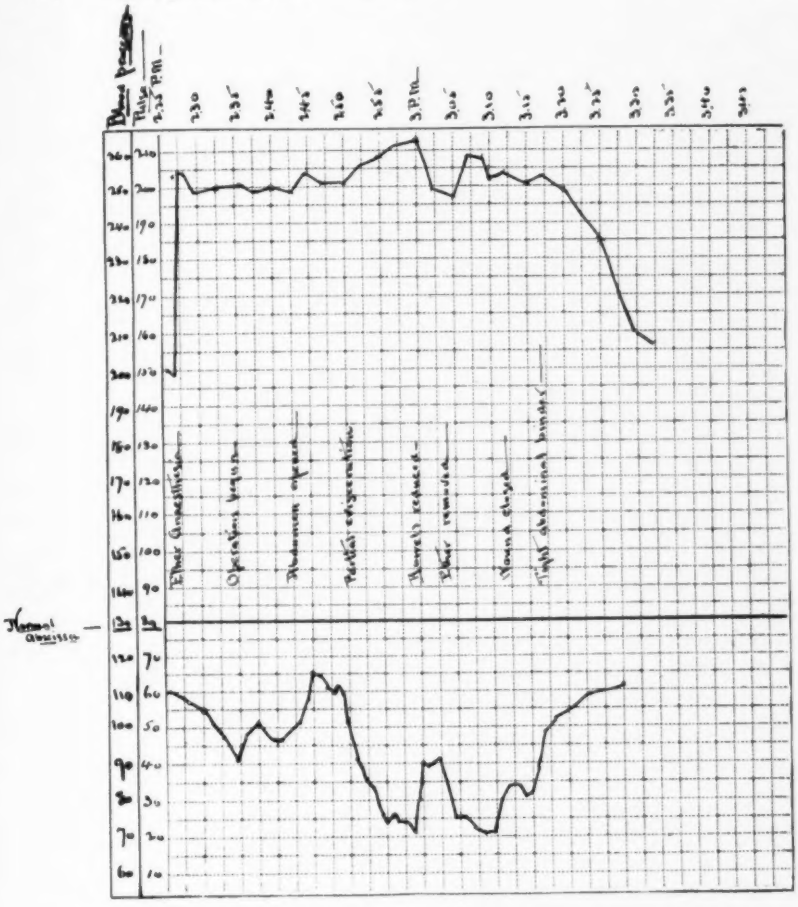

FIG. 11.—Chart I showing pulse-rate and blood-pressure curves during an abdominal operation on a feeble child for tuberculous peritonitis. The abscissa line represents an average normal pulse-rate, 80, and an average normal blood-pressure, 130 millimetres of mercury.

Note (1) Condition before beginning anæsthetic; rapid pulse, 150; low blood-pressure, 110. *Note* (2) Effects of evisceration. *Note* (3) Beginning of shock and fall in blood-pressure; cf. no especial change in pulse. *Note* (4) Result of application of tight abdominal binder.

CHART II.—(Fig. 12.) *Cerebral Group. Gasserian ganglion operation.* The chart illustrates the normal response in intra-

cranial cases when the brain is subjected to compression. This response is the exact counterpart of the experimental one heretofore described as accompanying cerebral compression. (*Johns Hopkins Bulletin,* 1901, Vol. xii, p. 290.) The compression anæmia apparently stimulates directly the vasomotor centre, which in turn raises the blood-pressure by constriction of the splanchnic territory, in degree sufficient to overcome the anæmia. The pulse is slowly affected meanwhile by a similar stimulation of the vagus centre in the medulla. The fall in blood-pressure associated with clamping of the ganglion and with its extraction shows that this might be a dangerous procedure if blood-pressure were already low. In critical cases of ganglion extirpation, doubtless the structure should be cocainized before handling, as in the case of any sensory nerve.[3]

CHART III.—(Fig. 13.) *Cerebral Group. Ganglion operation.* Shows a rapidly fatal case of shock in an intracranial operation with paralysis of the vasomotor centre and consequent fall in blood-pressure. Here the normal response with rise in blood-pressure and slowing of pulse did not take place during the compression of the brain. Possibly this was due to extensive pathological alterations present in the blood-vessel walls. The rapid fall in blood-pressure even before there was any outspoken change in pulse-rate should have been an indication to immediately abandon the operation. Owing to the low blood-pressure the ganglion was removed with a minimum of bleeding in this case. The usual therapeutic measures to restore arterial tension proved futile.

[3] It is important to note that this rise in blood-pressure is the occasion of the troublesome bleeding so often encountered in ganglion operations. It was my practice formerly to administer chloroform in these and in all cases of cranial operation as has been advocated by Mr. Horsley. Our blood-pressure observations have sufficed to show its great danger. In the majority of instances there is a fall in blood-pressure associated with the administration of chloroform which accounts for the lessening of hæmorrhage under this form of anæsthesia. Any further depression of blood-pressure from the operative procedure itself could easily and rapidly bring about a fatal condition of shock. Elevation of the head may oftentimes control the oozing in these cases. This posture is accompanied, however, with risk, which should be estimated and controlled by frequent observations on blood-pressure. The principle of cocainization of the ganglion before its manipulation and extraction has been carried out in my last cases.

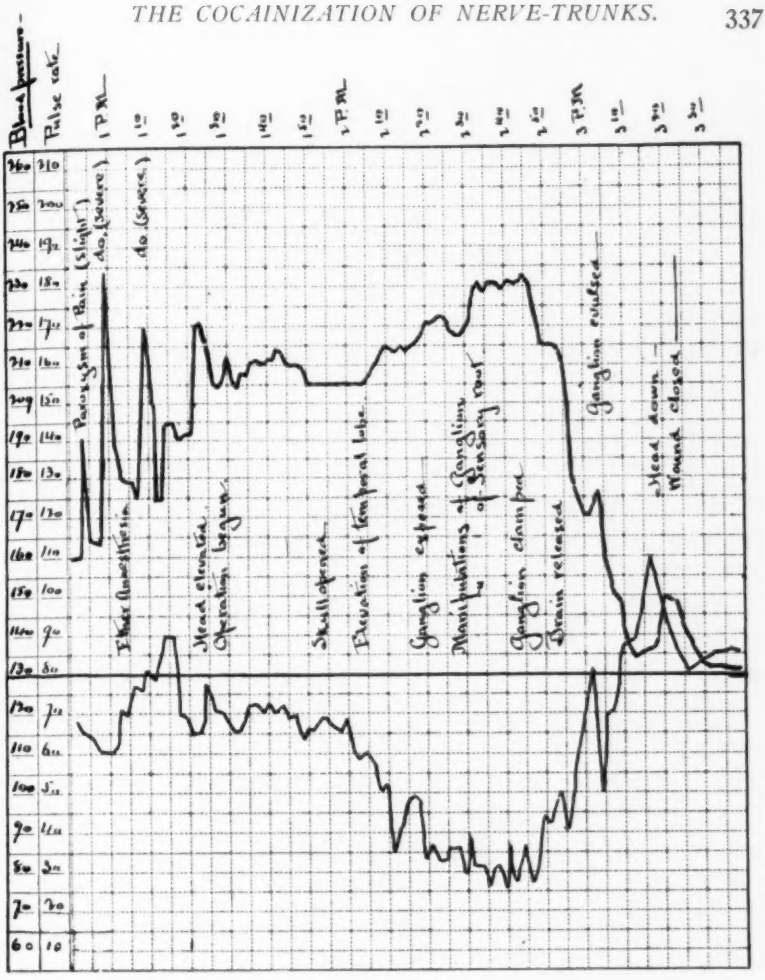

FIG. 12.—Chart II. Pulse-rate and blood-pressure curves taken during an operation for extirpation of the Gasserian ganglion; ether anæsthesia. Upper line represents blood-pressure; lower, pulse.

Note (1) Great excursions of blood-pressure during the paroxysms of the "neuralgia quinti major," unassociated with any change in pulse-rate. *Note* (2) The rise in blood-pressure from its "ether level" at 205 millimetres of Hg. to 230 millimetres during the elevation of the temporal lobe and associated compression of the brain.

Note (3) The corresponding retardation of pulse-rate from sixty-five to thirty beats per minute due to vagus stimulation. *Note* (4) The return of pulse-rate and blood-pressure to normal levels after the release of the brain from compression.

CHART IV.—(Fig. 14.) *Peripheral Group. Stretching sciatic nerve.* Shows the physiological response as a rise in blood-pressure consequent upon the handling of an important mixed peripheral nerve-trunk in a normal individual. Here an accelerator and pressor response are combined. In other instances there may be no increase in pulse-rate.

CHART V.—(Fig. 15.) *Peripheral Group. Complete breast operation.* Shows the absence of any appreciable effect on pulse-rate or blood-pressure other than the usual rise during the primary stage of ether anæsthesia. In such an operation there is no loss of blood, and no important sensory nerve-trunks are divided or handled. (Contrast pulse-rate with Figs. 4 and 9.)

In these three groups of cases—*abdominal*, *cerebral*, and *peripheral*—the blood-pressure alterations are occasioned, generally speaking, as follows: In the first group they are brought about largely by direct peripheral action on the splanchnic vascular system; in the second, by direct action on the vasomotor centre in the medulla; in the last, by reflex effect of peripheral sensory impulses acting through the medullary centres upon the vascular fields. Thus the reflex sensory vasomotor arc, so to speak, may be acted upon through any one of its component parts.

PHYSIOLOGICAL NOTES.

An attempt has been made in the introductory paragraphs of this communication to summarize briefly the present conception of the term "traumatic shock," its method of production under ordinary circumstances, and the means by which in certain cases it may be avoided.

The experimental observations by Fischer, Goltz, Seabrook, Crile, and others have shown that the weakened or paralyzed condition of the vasomotor centre in the medulla, brought about reflexly by the mechanical injury to peripheral sensory neurones, plays the chief *rôle* in inaugurating a state of shock. The loss of control over the general arterial tone which results from this weakening of the centre results in a determination of blood in certain vascular fields. Of these

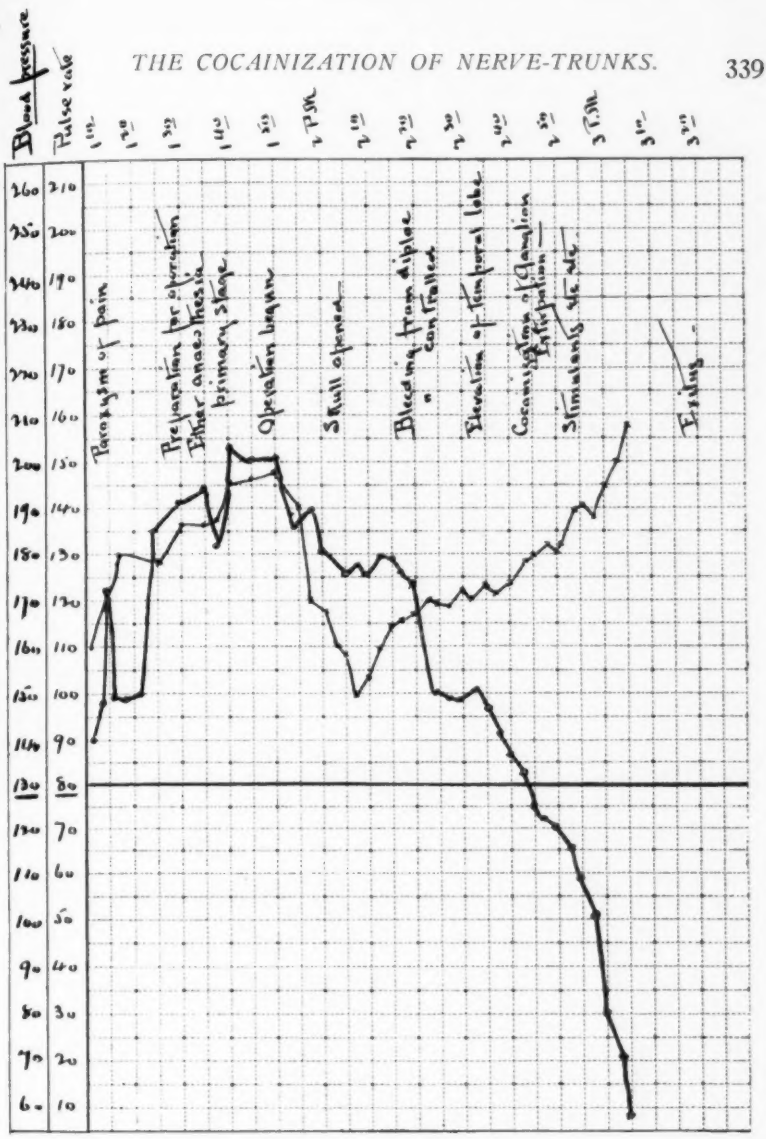

FIG. 13.—Chart III. Pulse-rate and blood-pressure curves taken during a fatal case of ganglion extirpation; ether anæsthesia. *Note* (1) The comparatively high blood-pressure and rapid pulse during the preparation of the patient and the early stage of anæsthesia.

Note (2) The fall in pulse-rate to 100, which should probably have been "ether level. *Note* (3) The drop in blood-pressure and acceleration of pulse from slight loss of blood during opening of skull. *Note* (4) The immediate fall in blood-pressure and rise in pulse during elevation of temporal lobe, the opposite of the normal reaction.

the largest and most important is the great splanchnic territory, the flooding of which side-tracks, as it were, such an amount of blood that there results an anæmia of the brain and lungs, a weakened cardiac action, or the "empty pump" principle of Goltz, and a consequent great fall in blood-pressure.

As has been stated in the brief discussion of the two cases which, early in this paper, have been cited at some length, there are certain predisposing factors which are influential in favoring this reflex loss of vasomotor tone. It is, in the first place, a well recognized physiological fact that stimulation, of one sort or another, of a peripheral sensory nerve of an animal in normal condition occasions a rise of blood-pressure or so-called "pressor" response due to a reflex constriction of the smaller arteries of certain vascular territories. Such a pressor response is frequently seen in clinical cases, and we have had the opportunity of plotting many such curves in correspondence with the experimental observations such as Dr. Crile has carried out. A patient in an attack of biliary colic, for example, will have a rise of blood-pressure from its normal level, corresponding possibly to 120 millimetres of mercury, to a level of 200 millimetres or over. A corresponding response occurs, as I have many times observed it experimentally, when there is a forcible injection of fluid into, and so as to distend, the biliary passage of an animal under anæsthesia. Similarly an attack of pain, such as is experienced in a paroxysm of trigeminal neuralgia, will raise the blood-pressure to inordinate heights. The increase in arterial tension under these circumstances may be unassociated with alteration in pulse-rate. Certain simple operative procedures as well, such as dilating the sphincter or stretching the sciatic nerve, as has been already instanced (Fig. 14), will call forth a pressor response.[4]

[4] When one sees recorded the pressor effects, which often occur in operative cases under anæsthesia, with a rise of arterial tension to double or more its normal level, it becomes a matter of astonishment that rupture of blood-vessels does not more often occur, especially in the feebly supported vessels of the central nervous system, and in patients who show evidence of alteration in the arterial walls. It is not improbable that the

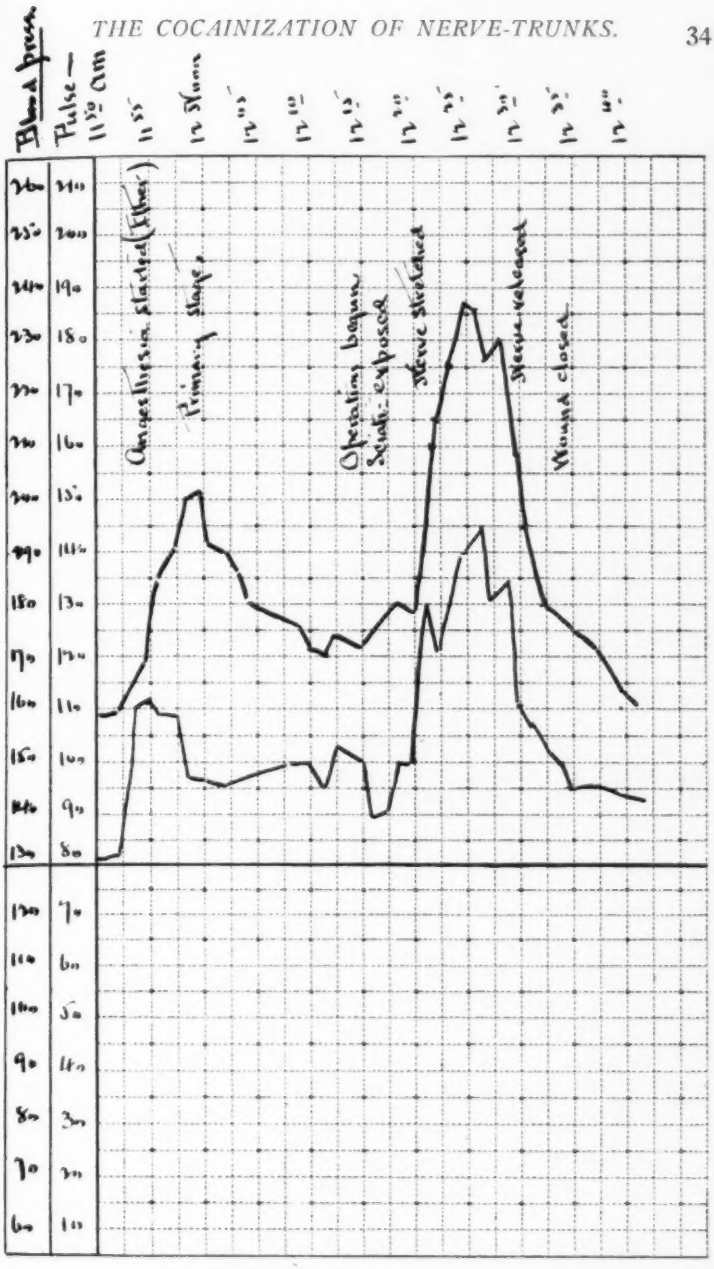

FIG. 14.—Chart IV. Pulse-rate and blood-pressure curves taken during the operation of stretching the sciatic nerve for sciatic neuritis; ether anæsthesia. Upper line, blood-pressure: lower line, pulse-rate.

Note (1) Rise during primary stage of anæsthesia and "ether level" of pulse, 95 to 100, and blood-pressure, 170 to 175. *Note* (2) The pressor effect (to 238 millimetres of Hg.) and accelerator response, 140 to 145, due to stretching the nerve for a period of ten minutes. *Note* (3) The return to "ether level" on releasing the nerve.

From the experimental side many observations have been made to determine the conditions which favor the calling out of the depressor rather than the normal pressor response to a given stimulus. The loss of blood or a coexistent primary anæmia, the exhaustion of an extensive operation or of prolonged anæsthetization, the repeated calling out of pressor responses from painful stimuli with consequent fatigue of the vasoconstrictor mechanism, and a great variety of other conditions might be mentioned in illustration; conditions which have long been recognized as prejudicial to the safe-conduct of certain operations.

Comparatively recent observations, chiefly those coming from Howell's laboratory, have been largely instrumental in establishing the view that in each bundle of mixed peripheral nerves there exist definite centripetal (" pressor") fibres, stimulation of which calls forth by reflex action a vasoconstrictor response, and others equally definite, which on the other hand produce when stimulated a depressor effect from reflex vasodilatation with consequent fall in blood-pressure. In the neck of the rabbit, as is well known from the classical experiments made in Ludwig's laboratory, afferent fibres subserving in a certain measures these different functions run apart and may be individually stimulated. One of these nerves has become known in consequence as " the depressor nerve," and must not be confused with the depressor fibres supposed to be present in other mixed nerves. Under ordinary circumstances, however, in the neck as well as in the nerves of the extremities, both pressor and depressor fibres run together in the same trunk and due to the fact that the former under normal conditions respond more readily and effectually to most forms of stimulation, a rise in blood-pressure is usually produced. Of these two sets of fibres, those having a pressor action seem to be the first to suffer from injury or over-stimulation, and when,

cases of sudden death, which on rare occasions have followed such simple procedures as stretching the sphincter ani for fistula, may be attributable to such an occurrence. Cases furthermore of anæsthesia apoplexy are by no means rare.

in consequence, they have become exhausted, the same irritation to the mixed nerve which previously would have called

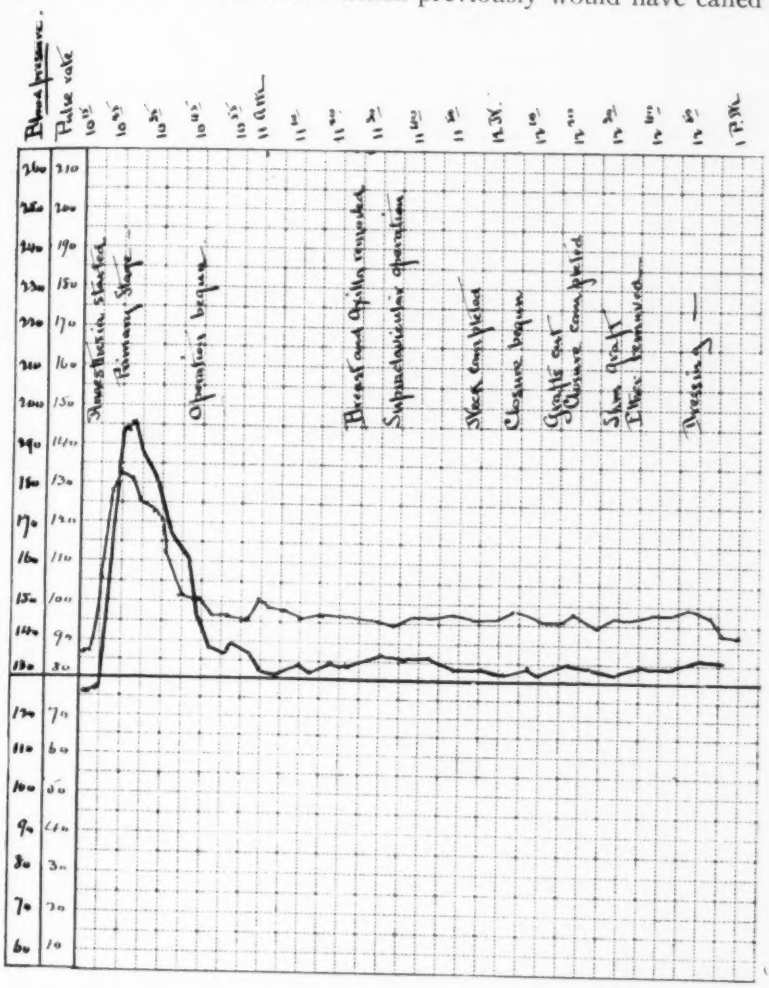

FIG. 15.—Chart V. Pulse-rate and blood-pressure curves taken during the Halsted operation for carcinoma of the breast. Heavy line, blood-pressure; light line, pulse.

Note (1) Slight deviation from normal levels except during primary stage of anæsthetization.

forth a vasoconstrictor action then elicits a fall in blood-pressure from stimulation of the still active depressor fibres.

Howell, for instance, has shown, when such a mixed nerve has been subjected to the effects of cold applied locally in its course, that it no longer calls forth pressor responses to peripheral stimulation, but that depressor effects may still be evoked. He and his pupils (Howell, Budgett, and Leonard, *Journal of Physiology,* 1894, Vol. xvi, p. 298) demonstrated, furthermore, in illustration of the fact that these two sets of fibres are functional entities, that after division of a peripheral mixed nerve those fibres calling forth reflexly a vasodilator response regenerate more rapidly than do those producing on stimulation a vasoconstrictor action.

Hunt [5] subsequently, working in the same laboratory, has further elaborated these studies, and has brought out the fact that in a fresh animal the depressor fibres may apparently be stimulated in excess of those subserving a pressor function by the action of weak electric curents. Strong currents, on the other hand, would produce the usual rise in blood-pressure from vasoconstrictor action. He has shown, also, in agreement with Kleen, that the mechanical bruising of muscles is apt to lead to a depressor effect. In confirmation of the observations of Latschenberger and Deahna (Latschenberger and Deahna, " Beiträge zur Lehre von der reflectorischen Erregung der Gefässmuskeln," *Pflüger's Archiv,* 1876, Band xii, p. 157) and others, Hunt's experiments demonstrate that on the repetition of a particular stimulus or injury, each of which, singly, would cause a rise in blood-pressure, a point is reached at which a pressor effect no longer occurs, but at which the same stimulus calls out a depressor response with fall in blood-pressure.

It must be confessed that there is no present uniformity of opinion among physiologists as to the nature of the depressor response. Conclusive proof even of the presence of depressor fibres, in the sense of Latschenberger and Deahna, is yet forthcoming. It is believed by some investigators that

[5] The fall of blood-pressure resulting from the stimulation of afferent nerves. Journal of Physiology, 1895, Vol. xviii, p. 381.

the fall in blood-pressure is due to alterations in the centre itself rather than the result of a reflex dilator action of specific afferent fibres. Whatever the mechanism of the response may be, however, the fact of its occurrence is sufficient for practical requirements; and, although the matter may have been presented here in an amateurish fashion, it needs but a glance to appreciate the importance to the operating surgeon of these laboratory observations. Their relation also to the clinical notes, which have been given in the first part of this paper, demands no written interpretation.

The facts remain that injuries of most diverse nature to peripheral nerves may, especially in some physical states, produce reflexly a fall in blood-pressure; that this loss of vascular tone, when it endures, is the most characteristic feature of shock, the symptom-complex of which is largely due to this one factor; that local anæsthetization of a nerve-trunk will block the transmission of the centripetal impulses which otherwise might bring about this reflex loss of vascular tone.

SUBPARIETAL RUPTURE OF THE KIDNEY.

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RECENTLY I have had to treat a case of subparietal rupture of the kidney, and, insomuch as a definite line of treatment of these cases has not been settled upon, I desire to add my experience in this case to those already recorded, and, at the same time, briefly to review the literature which has accumulated since the most valuable contribution on this subject from W. W. Keen, in 1896.[1]

The statement that the mortality of subparietal rupture of the kidney is greater than that of gunshot wounds of that organ, and over four times as great as from nephrectomy in general,[2] seems paradoxical, but, nevertheless, it is true; and I think it may be incontrovertibly said that it is because the wisdom of the masters has not been disseminated generally among the profession.

It is to reiterate the teachings of Küster,[3] Tuffier,[4] Grawitz,[5] Maas,[6] Keen,[1] Fenger,[7] Morris,[8] and others, in regard to the early operative treatment, and to emphasize the importance of their conclusions, and not to offer suggestions of my own, that I enter into this subject.

The series of cases comprising my report commences from the beginning of 1897, from the time of Keen's report, and includes the year 1901, a period of five years. In some of the cases the reports are not complete, but sufficient evidence is manifest to confirm the conclusions of the authors mentioned.

I will first give the history of my own case, which is briefly as follows:

The patient, H. P., aged eighteen years, was referred to me by Dr. I. N. Albright, of this city, on September 29, 1901.

He is a young man of excellent family history, with no previous illness nor bad habits; a rough rider, of athletic build, whose appellation was derived from his being a member of the volunteer rough riders cavalry corps of this city.

He was injured while engaged with his company in the drill of mounting and dismounting horses. He was standing behind his horse when he received a severe kick from it in the right side of the abdomen, which knocked him down and rendered him momentarily unconscious. He suffered violent pain in the abdomen and loin, and could not move because of its exacerbation. He was picked up by his comrades, carried to a vehicle, and taken home. Dr. Albright was called at once, and he administered morphine to relieve pain. The chief symptoms observed up to the time when I first saw the case were: bloody urine, frequent and severe vomiting, which at first was of stomach contents, and in forty-eight hours became a brownish liquid of fæcal odor; constipation, which did not yield to calomel and salines per mouth and numerously repeated rectal injections, and severe, spasmodic pains in abdomen.

Dr. Albright had made the diagnosis of injury to the kidney. On my first examination, the patient presented the appearance of being very ill and suffering severely. He was lying, slightly inclined to his left side, with his right thigh flexed on the abdomen, which was distended, tympanitic, rigid, and very sensitive to palpation over the right side. His bowels had not moved. He had vomited frequently that day, and the last three times the vomitus had a fæcal odor. There was fulness in the ileocostal space and great tenderness on pressure in the loin. His pulse was 118; temperature, 101° F.; and respirations, 28.

I advised sending him at once to the hospital, which was done, and I operated upon him one and a half hours later, at 2.10 P.M. (He left the operating-room at 4.) Chloroform was the anæsthetic used.

The incision was made through the right linea semilunaris, over the part said to have been about the seat of the impact of the horse's foot. There was no external evidence of injury.

On opening the abdomen, a small amount of gas and bloody fluid emerged. Laparotomy sponges were used and the fluid partly removed. Inspection showed the ascending colon to be enormously ballooned, livid, and with a rupture of the peritoneum over its anterior or free surface. The lacerated wound

was about two inches in length and parallel with the long axis of the gut. The muscularis was slightly torn and presented a bruised appearance. There was oozing of dark blood from the wound surface.

The dark outline of the kidney could be seen, and palpation elicited fluctuation around it. The peritoneum was not torn. The only evidence of peritonitis was a slight fibrinous exudate on the colon for a short distance about the wound.

The abdominal cavity was wiped out with laparotomy sponges. The tension and contusion of the colon tissue forbidding suture, five strips of iodoform gauze were placed as follows: Two over the wound of the colon to relieve the oozing and to provide drainage in case of subsequent perforation of the gut; the others in the most dependent part of the peritoneal cavity. The uncertainty of the extent of the intestinal injury and the presence of gas in the peritoneal cavity seemed to me to demand drainage, although no macroscopical change of the peritoneum was discernible excepting that referred to, immediately surrounding the wound.

The abdominal wound was partially closed with the figure-of-eight silkworm-gut sutures. The patient was then placed on his left side in a Turner kidney saddle, and a nephrotomy done through the usual incision in the ileocostal space. The perirenal capsule bulged into the wound. It was opened and a considerable quantity of clots and fluid escaped. The sac was wiped out and the kidney inspected. There was a deep wound about the middle of the kidney extending through the anterior surface from near the convex border into its pelvis.

A rubber drainage tube was introduced into the wound, and a few strips of iodoform gauze were packed around it to check the hæmorrhage, which was not profuse. The external wound was sutured with silkworm gut. A voluminous dressing was applied, and the patient taken to his bed.

Subsequent History.—Tubage at once relieved the colon from the gaseous distention. No food was taken into the stomach for five days. Saline enemata resulted in slight bowel movement, with free escape of flatus, in twenty-four hours; fair bowel movement in thirty-six hours. Nutrient enemata given for five days. Gauze packing removed from abdomen after thirty-six hours. Disappearance of all serious symptoms in seventy-two hours.

October 14. Tube removed from kidney (the sixteenth day); at that time patient's urine passed from the bladder was normal. His temperature was 98.6° F.; pulse, 70, and remained so for ten days; the discharge from the wound grew less each day.

October 24. Intern injected fistula with iodine, for some inexplainable reason. It provoked attack of great pain in loin, radiating down to groin and to the bladder. Temperature, 102.2° F.; pulse, 120; respirations, 26, four hours later.

October 27. I had been out of the city for one week, and Dr. Bayard Holmes kindly took charge of the case in my absence. The temperature and discomfort continuing, Dr. Holmes slightly reopened old tract under Schleich's local anæsthesia. Some blood and pus escaped. Rubber tube and gauze drain inserted.

October 29. Temperature, 99° F.; pulse, 76; patient more comfortable.

November 11. For past week patient has had temperature rising as high as 103°, accompanied by severe renal colic. I reopened kidney (the patient under chloroform) and removed two disintegrating clots from kidney pelvis, and reinserted tube and gauze.

November 13. Temperature, 98.6°; pulse, 80.

November 18. For the past week patient has had severe pain of a neuralgic character, deeply seated in the umbilical region, requiring frequent hypodermic injections of morphine. Refuses food. Pulse becoming more frequent. Urine contains pus. Nephrectomy.

Operation.—Incision through old scar down to kidney, which was liberated from its attachments. The vessels and ureter were ligated with catgut just below the hilus and severed. There was some bleeding. Two hæmostatic forceps were placed on stump, and both angles of the wound were closed with silkworm-gut sutures.

November 19. Pulse, 126; temperature, 98°.

November 20. Pulse, 114; temperature, 100°.

November 21. Pulse, 90; temperature, 98.6°. Pain wholly disappeared. Urine showed trace of albumen and a few pus cells. For days following the nephrectomy, the dressings were saturated with urine and the urine passed from the bladder in but small quantities. A solution of methylene blue was injected into the bladder, and it passed through the ureter and stained the dressings.

November 26. Urine shows slight trace of albumen.

December 22. Left the hospital. Fistula tract closed; urine normal; patient able to walk about, feeling quite well.

Pathological Findings.—Macroscopically, the kidney showed exceedingly slight change, and that only at the seat of the wound. About this region there was an area of slight pressure necrosis from the drainage tube. The pelvis epithelium was clear, the pelvic wall not thickened. The fistulous tract was small. There were no pockets about the kidney, and the kidney itself was not enlarged. From the appearance of the kidney after its removal, it seems almost an unnecessary sacrifice to have removed it. It is probable that if the drainage had been adequate and the clots removed, and if the iodine injection had been omitted, the nephrectomy would not have been done. But the general condition of the patient became so bad, and there was uncertainty as to the pathological condition which occasioned his suffering after free drainage had been effected, so it seemed imperative to remove the kidney without further delay, while the patient had still the strength to withstand the operation.

At no time was there anuria, nor a very greatly diminished secretion of urine. Often-repeated urine analyses are recorded on the history sheets, but there is nothing important in them.

Of the thirty-four cases which I have collected from the literature, the abstracts in brief are as follows:

CASE I.—Johnson.[9] Blow over left side; sharp local pains; admitted to hospital immediately. Symptoms of internal hæmorrhage; left loin tender, swollen, dull below ribs; blood urine. Second day, temperature, 102.3° F.; third day, 104.6° F.; condition bad.

Operation.—Lumbar incision. Large hæmatoma; left kidney completely torn through middle. Nephrectomy, drainage. Uneventful recovery. Kidney almost pulpefied.

CASE II.—De Kammerer[10] reports case with diagnosis of perinephritic abscess. Upon operation, found ruptured kidney. Nephrectomy. Recovery.

CASE III.—Hughes.[11] Car-crushing injury; profound shock; urine almost pure blood. After eighteen hours, urine clear. Died, peritonitis, three days after injury. Post-mortem; kidney torn completely through at pelvis; large extravasation around kidney; intestines not injured; spleen lacerated.

CASE IV.—Nash.[12] Boy kicked by horse, about tenth rib. Immediately severe pain in right side, at lower edge of ribs. Tenderness anterior and posterior; eight hours afterwards passed "porter-colored" urine; after forty-eight hours, urine clear. Fulness in flank and expected peritoneal

injury. Pulse rapid; temperature, 101.4° F. Condition bad. Operation on sixth day. Lumbar incision; black clot beneath aponeurosis, loose piece of detached kidney found, and kidney itself lying in mass of blood and *débris*. Cavity washed out; three-eighths of kidney destroyed. Clean incision in kidney extending just to the pelvis. Free irrigation, drainage,—gauze and tube and suture; convalescence uneventful.

CASE V.—Link.[15] Man kicked by horse, right kidney region. Walked into soldiers' quarters; great pain in right side; immediately passed bloody urine; symptoms of shock, subnormal temperature; pain in right side, abdomen, and right testicle; dulness almost to Poupart's ligament on right side; vomiting bile-colored fluid. Right side packed with ice-bags. Improvement under treatment for twenty days; at times passed bloody urine. Sudden rise of temperature; pleurisy, with exudate in right side. Condition grew worse, and operated forty days after injury.

Lumbar incision, opened large abscess. Kidney torn completely in halves and lower half split; upper half healthy, lower necrotic; removal of lower half of kidney, suture of pelvis, and gauze pack. Temperature remained high and condition not improved after ten days, second operation and remainder of kidney removed; recovery.

CASE VI.—Wheeler.[14] Child run over by cart. For one hour after admission to hospital, plays on floor, with no symptoms. Showed sudden weakness and collapse, and died within three hours.

Post-mortem.—Three wide tears in right kidney and three in liver. Child had passed urine after admission to hospital, with no traces of blood.

CASE VII.—Brockman.[13] Man kicked by horse. No external wound. Slightly bloody urine at first.

Operation.—Lumbar incision; kidney completely divided; artery not injured, but ureter destroyed. Packed and drained. Death two days later.

CASE VIII.—Injury coasting. One hour later, pain in right side and in testicle; two hours later passed bloody urine; after twelve hours, very anæmic; tense tumor over right kidney.

Operation.—Kidney surrounded with blood; rent from pelvis, half-way through organ. Packed with gauze; healed completely in six weeks.

CASE IX.—Heaton.[16] Boy fell about six feet, striking over a bar. Put to bed; vomited, but felt fairly well. Several hours afterwards passed pure blood, and showed signs of hæmorrhage and collapse. Pulse, 95; temperature, 96° F.

Operation.—Abdominal incision in right semilunaris. Peritoneum contained much blood. Irregular rent in right kidney and in peritoneum over it. Kidney removed and hæmorrhage continued; rent found in lower surface of liver; liver wound packed; patient in collapse.

For first five days, condition good; then in next ten days, symptoms of anæmia, and temperature. Abscess, with bile and pus drained in bed of kidney. Recovery.

CASE X.—Rogers.[17] Girl fell four feet; little discomfort until following morning. Brought to hospital; not seen by author until twenty hours later. Found feeble pulse, sighing respiration and collapse; passed almost pure blood; fulness and tenderness in right lumbar region.

Operation.—Lumbar incision. Kidney surrounded with blood, double

tear diverging from hilum. Nephrectomy and packing of wound. Patient did not recover from shock.

CASE XI.—Paton.[18] Man fell while walking, striking left side on a box. Walked home; much pain and vomiting; came to hospital a few hours later. Faintness; temperature, 100.2° F. Fracture of left twelfth rib; abdomen not distended; perhaps slight increase in dulness in both flanks; urine slightly bloody. Next day, condition same. No blood in urine; bowels moved; temperature under 100°; abdomen distended; flank dulness movable; passed thirty-eight and one-third ounces of urine in twenty-four hours. For next twelve days, no blood in urine, condition improving; sat up, had no pain, and passed about forty ounces of urine a day.

On twelfth day, pain in left loin; distinct tumor, dull, elastic, and extending down to iliac fossa; pain down course of ureter; urine normal; next day, swelling and pain increased. Incision into left loin, below level of usual kidney incision, opening perinephritic tissue. Two pints of clear, urinous fluid escaped; cavity extended to brim of pelvis and to kidney above; no opening into kidney, ureter or peritoneum found. Tubular drain. Drained for sixteen days. Complete healing.

CASE XII.—Bernays.[19] Fall against wagon-wheel; pain severe; percussion dulness over right side; urine bloody.

Operation.—Kidney in large hæmatoma; entirely loose; vessel torn across, but not bleeding; ureter intact. Nephrectomy; drainage; recovery.

CASE XIII.—Trimble.[20] Man fell from train; twelve hours later, severe shock, vomiting, pain in kidney region extending along course of ureter to bladder; pain in testicle; urine bloody, with wormlike clots; bladder washed out. Recovery after six weeks.

CASE XIV.—Hersey.[21] Fall thirteen feet; no external injury; shock severe; pain in right lumbar region; bloody urine; abdomen distended.

Operation.—Abdominal; no injury to intestines; abdomen filled with blood. Lumbar incision; kidney ruptured below pelvis; nephrectomy; death from shock; operation thirty-six hours after injury.

CASE XV.—Struck by timber. Severe pain, bloody urine, flatness extending from eighth rib behind to iliac crest.

Operation.—Lumbar incision; eight ounces of blood in retroperitoneal space; kidney with wide, gaping tear; nephrectomy; recovery.

CASE XVI.—Rutherford.[23] Patient admitted to nospital twenty-four hours after injury from wagon-wheel. Bloody urine; pain all over abdomen; dulness over right side; no bulging; pain constant and severe; no shock; temperature, 101.2° F. Operation next day. Lumbar incision; kidney torn across and separated from artery and vein. Nephrectomy; recovery.

CASE XVII.—Troyman.[25] Rupture of kidney; nephrectomy; recovery.

CASE XVIII.—Gardinier.[24] Soldier kicked by horse; walked part way to hospital; no external wound; severe pain in left loin; passed bloody urine several times; died same day.

Post-mortem.—Rupture of left kidney and spleen; capsule of kidney ruptured and kidney torn into two nearly equal halves. Rupture in lower end of spleen.

CASE XIX.—Kolliker.[25] Patient fell short distance. Bloody urine and pains extending to bladder. Seen first on fourth day. Urine still slightly bloody; fifth day, urine clear; sixth and seventh days, slightly bloody; eighth day, urine clear and rise of temperature. On ninth day, œdema, with severe pains in left side. Condition growing worse; high fever and anuria.

Operation on tenth day. Region of kidney and its capsule œdematous, infiltrated with blood and urine; broad tear between middle and upper third. Irrigation and packing. Healed completely in seven weeks; no urine discharge after five and a half weeks.

CASE XX.—Franz.[26] Rupture of kidney from muscle contraction. Bloody urine and pain. Recovery without operation.

CASE XXI.—Rupture of left kidney from fall. No bloody urine for seventy-two hours; then urine became bloody, with other symptoms of kidney rupture. Recovery with secondary nephritis. No operation.

CASE XXII.—Mudd.[27] Fall of six feet, striking right side; profound shock; bloody urine; condition good for fourteen days, then appearance of tumor in right side. Incision next day, with discharge of bloody fluid. Patient died twenty-one days after injury.

Post-mortem.—Tear in middle of kidney, half-way through its body.

CASE XXIII.—Fall from sled. Shock profound; bloody urine within few hours; clear after eighteen hours. Tumor in right side from crest of ilium to liver, and extending to median line. Condition good for thirty hours; later, temperature, 101° F.; pulse, 140.

Operation.—Lumbar incision; retroperitoneal space filled with blood; kidney lacerated; nephrectomy; recovery.

CASE XXIV.—Injury from wagon-wheel. Shock profound; bloody urine at once; clear after twenty-four hours. Author saw patient first thirteen days after injury. Temperature, 103° F.; large collection of fluid in right loin; lumbar incision; bloody fluid and clots discharged; kidney torn so that one-third was completely free. Nephrectomy; recovery.

CASE XXV.—Injury from wagon-wheel. Operation, severe contusion with slight laceration of kidney and injury to ureter; packed and drained. Later, nephrectomy; complete recovery.

CASE XXVI.—Fall of six feet, striking upon side. Severe shock for five days. Tumor found extending from ilium to costal border. No operation. Tumor absorbed in five days; recovery after three months.

CASE XXVII.—Bland-Sutton.[28] Rupture of kidney; abdominal nephrectomy; recovery.

CASE XXVIII.—Turner, G. R.[29] Rupture of kidney in two pieces; abdominal nephrectomy; recovery.

CASE XXIX.—Moyniham.[30] Fall down hill. Symptoms of internal hæmorrhage and bloody urine. Operation twelve days later; lumbar nephrectomy and recovery.

CASE XXX.[31] Rupture of right kidney; lumbar nephrectomy; recovery.

CASE XXXI.—Horse-kick; walked into hospital; pain in abdomen severe; probably intestinal injury. Lumbar incision; kidney torn and bruised; tubular drainage and packed; recovery.

CASE XXXII.—Tucker.[32] Man received a crushing injury on street-

car. Admission to hospital two days later; had passed bloody urine previous to admission. Palpation revealed marked tenderness on left side from margins of ribs to crest of ilium; externally, black and blue. No operation; treated by internal medication and rest; recovery.

CASE XXXIII.—Halstead.[38] Injured under wagon-wheel. Severe pain in right abdominal region; pain and deep tenderness and rigidity of abdominal wall; no external evidences of injury.

Operation.—Nephrectomy; large hæmatoma about kidney; no blood or urine from the kidney at the time; gauze drain; rupture on convex border of kidney; recovery.

In the general consideration of the subject of subparietal rupture of the kidney, we will first consider:

Etiology.—Küster has demonstrated upon the cadaver that rupture of the kidney takes place from hydraulic force, and that whether from direct violence to the body, as from a blow over the loin or the abdomen, the kick of a horse, being run over by a carriage, or from indirect violence, as from a fall. In the words of Küster:[3]

"The only theory which satisfactorily explains the lacerations of the kidney found after abdominal injuries, which do not cause penetrating wounds, is that of hydraulic pressure, acting through the full vessels and pelvis and causing the organ to burst along lines for the most part radiating from the hylus towards the point of maximum impact of the lower rib, the opposing resistance being supplied by the vertebral column.

"Experiments performed on flaccid kidneys thrown with some force against the floor proved that only superficial grazing or laceration was thus produced.

"On the other hand, when the pelvis and arteries were injected and ligatured, after closure of the vein, and the organ then thrown down, there ensued deep laceration of the kidney substance, the chief tear always taking place between the point of impact and the pelvis, which was not infrequently opened; other rents had a radiating direction. A most important observation in these experiments was that the edges of the rent were everted, and in one case the pelvic fat was forced outward between the edges of the fissured parenchyma. When the force was applied to the convex border, the fissures took a longitudinal direction."

"In prosecuting these experiments further on the human body, Küster found that it is easy to push forward the lower ribs until they touch the kidney, and even force it towards the vertebral column, though on the right side the liver offers some resistance." (Morris.[8])

Güterbock[34] (1895), in 326 autopsies on persons in whom death resulted from accidents, found thirty-six instances of ruptured kidney, representing 10 per cent. of the injuries. Eighty per cent. of the cases occurred in males. One hundred and forty-two of the injuries occurred on the right side and 118 on the left side, twelve being bilateral. In my collection of thirty-four cases, thirty-one were in males, 90 per cent.; three were in females, 104 per cent.; eighteen were of the right kidney, seven were of the left kidney, nine cases not known.

While in a large majority of the cases recorded force of great violence occasioned the rupture of the kidney, it is important to note that in a few instances seemingly forces of lesser degree were adequate to cause this lesion *e. g.* "Those of Campbell,[35] a young girl of fourteen, who doubled up her body forcibly to the left side in jumping a hedge, and immediately experienced severe pain with collapse, and the passage of bloody urine. Also the case of a soldier, who, while boxing with a comrade, was seized with sudden pain, and died of rupture of the kidney." And in one case in my own series, a man, attempting to protect himself from a falling object while loading a wagon, felt a sharp pain in the right side, had almost immediately slight shock, pain, and bloody urine. He recovered without operation.

The character of the injury mentioned in the reports of my collection was as follows: Involving the pelvis, thirteen; involving the parenchyma only, eight; part of kidney entirely separated, two; ureter injured, two; vessels injured, three; multiple tears, three; tear of peritoneum, two.

In two cases there was rupture of the spleen; in two, rupture of the liver; in one case there was a fracture of the twelfth rib, and in one there was secondary sepsis.

The author's case was the only one of intestinal injury, and in only one other was such injury suspected and an exploratory laparotomy made. The complications were not specified in the three cases of sudden death.

Symptoms.—The symptoms of ruptured kidney are pain, hæmaturia, and tumefaction. The pain, at first severe, is in the region of the kidney, the patient not being able to stand. Later may be added radiating pains to the groin and bladder. The mobile pain, incident to muscular traumatism, either of the back or abdomen, or both, is usually present, and the patient desires to remain in a fixed position. Hæmaturia is present in most of the cases, the exception being in the slight cases and where the ureter is not patent, or is completely ruptured. Tumefaction is generally present, the exception being the slight cases, and the very grave cases of rupture of the peritoneum. Shock is not a characteristic symptom, although it is recorded in many cases. Anæmia, proportionate to the amount of hæmorrhage, is a valuable symptom. Vesical and renal colic, from clots, etc., and alteration in the amount and character of the urinary secretion, may aid in the diagnosis of renal injury.

In my series, hæmaturia was absent in but one of the cases where the urinary symptoms were noted. Tumefaction was noted in twelve cases, but was not mentioned as absent in the others. Shock was mentioned in fifteen cases. Intraperitoneal hæmorrhage in four cases. Pain was noted in seventeen cases, and in many of the others the symptoms were not mentioned. The abstracts in these cases were very deficient in symptomatology.

Prognosis.—With the knowledge of the readiness with which clean kidney wounds heal, it is probable that a large number of lesser injuries of that organ recover without the attention of the surgeon, or even the diagnosis of the lesion being made; but of the cases where the diagnosis of rupture cannot be questioned, the mortality has been very great; certainly up to recent times, amounting to one-third of the cases.

The causes of death have been, in the main, from hæmorrhage and sepsis. Shock, nephritis, and anuria claimed a few

cases only. Tuffier,[4] in 1888, reports nineteen cases of secondary surgical intervention, with nine recoveries. His table shows that 52 per cent. died after long suppuration and subsequent surgical operation. Keln,[36] in 1894, gives eleven cases of nephrectomy for injury. To this last Wallis[37] adds eleven more. Of twenty-one of these, fourteen were subcutaneous lacerations,—nine recovered and five died (seven were perforating injuries with six recoveries and one death.) In the Billroth Clinic,[2] since the days of antiseptic surgery, the mortality of nephrectomy in general has been 5 per cent., before then it was 35 per cent. Kiemser,[38] from 1881 to 1895, at Seeman's Krankenhause, Hamburg, has ten nephrectomies with two deaths. The author states that the high mortality is due to the lateness of the operation.

Keen[1] reports: 118 cases of rupture; sixty-seven recoveries; fifty deaths; one under treatment at time of report. Mortality of 42.7 per cent. Of the fatal cases, seventeen should be left out for the following reasons:

One case had no other kidney; two cases had injuries of both kidneys; two were found dead; twelve had other complications. Omitting these, gives a general mortality of 33 per cent.

Thirteen early deaths, no nephrectomy; eleven of these from shock and hæmorrhage; two from hæmorrhage, shock and peritonitis; ten late deaths, no nephrectomy; all but two from sepsis; two from hæmorrhage. Had these twenty-three had early nephrectomy, it would probably have reduced the mortality to 23 per cent.

Twenty-two cases of nephrectomy; mortality, 36.4 per cent.

Ninety-five cases, no nephrectomy; mortality, 44.2 per cent., and it was only in the grave cases that nephrectomy was done.

Five cases of primary nephrectomy; one death; 20 per cent.

Thirteen cases, secondary nephrectomy; mortality, 38.5 per cent. Causes of death, primary hæmorrhage and shock,

eleven; found dead, two; peritonitis, five; coma, two; pneumonia, one; sepsis and exhaustion, ten; anuria, one; nephritis, one; uncertain, one.

Two cases of partial nephrectomy, with recovery.

In my series of thirty-four cases, there were seven deaths; mortality of 20.5 per cent.

With operations, twenty-six cases, four deaths; mortality, 15.3 per cent.

Without operation, eight cases, three deaths; mortality, 37.5 per cent.

Drainage, nine cases, two deaths; 22.22 per cent. mortality.

Nephrectomy, eighteen cases, two deaths; mortality, 11.11 per cent.; but these two deaths were on acount of hæmorrhage and the operation having been done too late.

Early operations, eighteen cases, one death; mortality, 5.5 per cent.

Late operations, eight cases, three deaths; mortality, 25 per cent.

Of the seven fatal cases, cause of death was in the three unoperated cases: (1) internal hæmorrhage; (2) internal hæmorrhage and shock; (3) peritonitis on third day. Operated cases, internal hæmorrhage and shock from lateness of operation in two cases; in two cases the cause was not given, one dying on the twenty-first day, after drainage of large hæmatoma on tenth day; the other died on second day, following immediate drainage.

Diagnosis.—The diagnosis of ruptured kidney is based necessarily on the symptoms of pain, hæmaturia, and tumefaction (and where rupture of the peritoneum is suspected, additional shock and anæmia); but insomuch as the kidney is but one of the anatomical structures injured in a given accident, it is necessary that a careful consideration of the history of each individual case be taken, in order to make the proper inferences as to the tissues most probably injured. A knowledge of the degree, direction, and point of application of the

force and the nature of the vulnerating body in direct violence throws as much light on these cases as it does in the study of fractures. The probability as to complications can be strongly conjectured.

In the author's case, the kick from a horse upon the abdomen, a blow of great force, as determined from the history, the patient having been knocked unconscious, with early symptoms of abdominal pain and rigidity, and vomiting, should have suggested serious internal injury and the necessity of operation at once. The operation done in seventy-two hours was in time to save life, but the patient's general condition was not so good as it had been, and the local condition in the abdomen was a threatening rupture of the colon and the presence of bloody fluid in the peritoneal cavity, making the most favorable condition for a general peritonitis.

Gage[39] has shown that where a body, such as a chunk of wood, has been thrown with great velocity, as from a rapidly revolving circular saw, against the abdomen, it should always suggest the probability of internal injury, and that such an accident would lead him to open and thoroughly examine the peritoneal cavity, if the clinical symptoms even suggested the possibility of intestinal rupture.

Treatment.—After the diagnosis of ruptured kidney is made the plan of treatment should seem quite clear in view of the history of the work reported in recent years. We should ascertain the full extent of the injury through an iliocostal incision; and if the organ is not irreparably injured, the hæmorrhage should be controlled by the ligature of torn vessels, or, if a parenchymatous oozing, by iodoform gauze packing. If the patient has lost a great deal of blood and there is a question as to whether life can be preserved should further hæmorrhage occur, nephrectomy must not be delayed. But on account of the isolation of the organ in its retroperitoneal fossa, the ease with which it can be brought into view for examination and treatment, without disturbing other structures, together with the good reparative power which it possesses, we

should generally pursue a conservative course and try to save the organ rather than to sacrifice it.

As to the management of kidney wounds in general, there are some differences of opinion among operators as to the wisdom of entirely closing them by suture. Believing that the subject is one of importance, I recently addressed letters of inquiry to a few leading surgeons, and through their kindness I am able to briefly report their experiences. The questions were as follows:

1. What has been your experience in complete closure of wounds of kidney (*a*) after nephrotomy in general; (*b*) after accidental wounds of kidney?

2. In what cases either after nephrotomy or after accidental wounds have you drained the kidney?

3. Have you any suggestions to make on the treatment of kidney wounds?

JOSEPH PRICE says: "Complete closure of any kidney wound has been unsatisfactory." He has drained all cases, either accidental wounds or nephrotomy, and suggests to "save as much renal structure as possible by careful surgery and drainage."

N. SENN has never resorted to the suturing of a renal wound.

J. B. MURPHY has found complete closure of kidney satisfactory after nephrotomy, except in suppurative inflammations of the pelvis. He has drained all accidental wounds. Drains the kidney in suppurative cases, and rarely after removal of calculus and in bullet wounds. He says, "I am in favor of treating all contused, incised, and lacerated wounds, except bullet wounds, by accurate suture, absorbable material."

A. D. BEVAN says: "I have closed six or seven kidney wounds completely after nephrolithotomy, and one after operation where the lesion was essential hæmorrhage. Five healed without any leakage. Have not closed any accidental wounds. Would drain all where the ureter was not free, and with gross amount of pus."

Suggestions as to treatment: "Primary closure as above for surgical wounds, nephrotomy for stone, and exploratory; gauze

packing for bullet wounds; suture for accidentally incised wounds. Always drain through external incision with cigarette drain, down to point of closure for forty-eight hours."

W. T. BELFIELD considers that complete closure after nephrotomy depends upon degree of infection; in least infected cases, wounds may be closed. Has had no experience in accidental wounds; would drain whenever suppuration was profuse.

L. L. MCARTHUR: "When septic conditions are absent, close renal wound, and drainage for retronephric space, forty-eight to seventy-two hours. Same treatment for accidental wounds."

"Drain all septic and some calculous pyelitis cases with soft, friable stones."

Suggests as to treatment that, "When hæmorrhage is excessive, not easily controlled, packing; remove kidney rather than risk fatal hæmorrhage."

A. J. OCHSNER says: "I have never completely closed a wound of the kidney after nephrotomy, nor after accidental wounds.

"I have drained all nephrotomy wounds for hydronephrosis, circumscribed abscess of the kidney, stone of the kidney and pyelitis, and a number of cases of tuberculosis which were not advanced; also gunshot wounds and also a few excisions of simple cysts in one end of the kidney.

"I have been satisfied with the treatment of kidney wounds by tamponing them with iodoform gauze and removing the tampons, a little at a time, after they became perfectly loose."

M. L. HARRIS writes: "I suture the kidney after nephrotomy in the absence of infection and suppuration, and when there is no interference with the free escape of urine from the kidney. I have never operated for an accidental wound of the kidney.

"I have drained the kidney in the presence of infection and suppuration."

W. J. MAYO: "After clean incisions and wounds of kidney, without infection, I have sutured with catgut and placed no drain in the kidney substance.

"Drain infected cases and lacerated wounds."

"The danger of fistula has led to nephrotomy in clean cases, in which direct incision of the pelvis would have been easier and

better. It is the infection of the pelvis that leads to fistula, and in which incision through the kidney substance would prevent this complication."

W. E. MORGAN: "I have never closed a case of nephrotomy or accidental wound."

"In all cases, use drainage."

"I believe in drainage, at least for a reasonable infection period to pass before closure, but might make an exception in exploratory measures where no infection is found, or in some gunshot wounds."

A. I. BOUFFLEUR has closed nonseptic case with satisfactory result. He uses drain only in septic pyelitis. "There is, in my opinion, no valid objection to primary suture of wounds of the kidney. The deep suture should control the hæmorrhage from the incision, which would seem to be the only argument against its use."

My own experience has been to drain every case. I have found it impossible, in the times which I have attempted it, to stop the parenchymatous hæmorrhage perfectly without gauze packing, and I do not consider it safe to suture such a bleeding surface. In the first place, it predisposes to sepsis and urinary extravasation, and in the second place to clots in the kidney pelvis, which may cause serious damage, either by obstructing the ureter or by causing sepsis, which may even extend to the sound kidney. And, lastly, it is contrary to the general surgical rule for the treatment of wounds to suture primarily either a contused or a lacerated wound, and for the reasons stated I think it would be contraindicated in the kidney.

In the treatment of complications, especially those of intraperitoneal structures, the same advance is being made as in the treatment of the kidney by early operation.

The conclusions of B. F. Curtis,[40] in 1887, based upon his experiments upon the cadaver in relation to the mechanical causation of intestinal rupture and upon the theoretical study of one hundred and sixteen cases, with reference to their clinical and pathological aspects, is now shown to be ultra-conservative

and erroneous by Homer Gage,[39] who in his conclusions drawn from recent experience says:

"Prompt recognition of the probability of visceral injury, exploratory incision, and the immediate repair of any wounds found in the intestine or mesentery are, I think, the steps which, if carefully, intelligently taken, will enable any one, who has the curiosity to look over the records of these accidents during the next fifteen years, to report a much more brilliant series of results."

My conclusions, based on the cases collected, and my own experience, are as follows:

(1) That the reduction in the mortality since Keen's report has been largely due to improved technique. Fewer deaths have been reported from sepsis. Several deaths have been reported from hæmorrhage which could undoubtedly have been avoided if more prompt and efficient means had been resorted to. I predict that the mortality will be reduced to 15 per cent.

(2) The expectant plan of treatment is permissible in cases where slight hæmaturia is the only symptom. Tumefaction—much blood in the urine, severe pain, and history of great violence, each is a positive indication for prompt operative intervention.

(3) Early operations should be done in all cases where the history of the case and the symptoms point to serious injury of the kidney. (*a*) Nephrotomy, with gauze tamponage, where the patient has not lost enough blood, so that little subsequent hæmorrhage would not endanger life. (*b*) Nephrectomy where the kidney is irreparably injured, and in less extensive injuries where either sepsis or hæmorrhage is likely to prove fatal.

(4) In delayed cases it may be difficult or impossible to know just what is best to do. Every phase of the case must be considered, and then, if in doubt, operate.

(5) Shock is the violent disturbance of the nervous system immediately consequent upon injury. While there is some ground for hesitation in those cases of true shock, most of the

cases described as shock are depression of the vital force from hæmorrhage or sepsis, and nothing short of prompt surgical intervention will prevent collapse.

(6) Operate on the history of the case rather than wait for symptoms which may only suggest what should have been done earlier, but at last proclaim without hope for relief.

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TABLE OF THIRTY-FIVE CASES OF CONTUSION OF THE KIDNEY.

No.	Injury.	Symptoms.	Lesion.	Complications.	Operation.	Result.	Remarks.
1	Blow.	Tumor; dull in loin; bloody urine.	Complete rupture.	None.	Third day; nephrectomy; drainage.	Recovery.	.....
2	.....	Perinephrectic abscess.	Complete rupture.	None.	Nephrectomy.	Recovery.	.....
3	Crushing.	Profound shock; urine, pure blood.	Rupture at pelvis.	Spleen lacerated.	None.	Death.	Peritonitis third day and death.
4	Horse-kick.	Slight shock; abdominal pain and bloody urine.	Rupture to pelvis.	None.	Sixth day, drained and packed.	Recovery.	Three-eighths of kidney removed.
5	Horse-kick.	Slight shock; pain; dulness; bloody urine.	Complete rupture.	Secondary sepsis.	Half kidney removed; later, nephrectomy.	Recovery.	1st operation, fortieth day; 2d, fiftieth day.
6	Wagon-wheel.	None for one hour, then an internal hæmorrhage; urine clear.	Three tears in kidney.	Liver torn in three places.	None.	Death.	Death in three hours from injury.
7	Horse-kick.	No external wound; shock; bloody urine.	Complete rupture of kidney and ureter.	Ureter ruptured.	Drained and packed.	Death, third day.	Immediate operation.
8	Coasting.	Pain in testicle; bloody urine; internal hæmorrhage.	Tear through pelvis.	None.	Drained and packed.	Death, third day.	Immediate operation.
9	Fall six feet.	Bloody urine; collapse after several hæmorrhages.	Tear of kidney and peritoneum.	Liver ruptured.	Abdominal nephrectomy and packed.	Recovery.	Secondary abscess.
10	Fall four feet.	Slight shock; later, collapse; internal hæmorrhage; bloody urine.	Double tear of one hilum.	None.	Lumbar nephrectomy and drainage.	Death.	Operation after twenty hours; shock.
11	Fall.	Slight pain; bloody urine; vomiting; dull in flanks.	.....	Fracture of twelfth rib.	Drainage of abscess on thirteenth day.	Recovery.	No tear of kidney found at operation.
12	Fall.	Severe pain; dull in right flank; bloody urine.	Kidney torn from vessels.	None.	Lumbar nephrectomy and packed.	Recovery.	.....
13	Fall from train.	After twelve hours, pain in testicle; bloody urine; vomiting and shock.	.....	.....	None.	Recovery.	.....
14	Fall eighteen feet.	Severe shock; pain in right testicle; bloody urine; tympanitis.	Rupture into pelvis.	None reported.	Lumbar nephrectomy after thirty-six hours.	Death.	Death from shock; no post-mortem examination.
15	Blow.	Severe pain; bloody urine; dulness to crest of ilium.	Wide tear of kidney.	.....	Lumbar nephrectomy immediately.	Recovery.	.....
16	Wagon-wheel.	General pain; bloody urine; dulness; no shock.	Kidney torn in two halves.	.....	Lumbar nephrectomy, second day.	Recovery.	.....
17	.....	.....	Rupture of kidney.	.....	Nephrectomy.	Recovery.	.....
18	Horse-kick.	Slight shock; severe pain; bloody urine.	Complete tear of kidney.	Tear in spleen.	None.	Death.	Died same day of shock and hæmorrhage.

19	Fall.	Slight pains in side and bladder; bloody urine.	Tear of kidney.	.....	Drainage on tenth day.	Recovery.	.....
20	Muscular contraction.	Bloody urine; pain and tenderness.	....	.....	None.	Recovery.	.....
21	Fall.	Slight shock and pain; bloody urine after seventy-two hours.	.....	Secondary nephritis.	None.	Recovery.	.....
22	Fall six feet.	Profound shock; tumor; bloody urine.	Tear half-way through kidney.	.....	Lumbar drainage on fourteenth day.	Death.	Died twenty-first day.
23	Fall from sled.	Profound shock; tumor; bloody urine.	Lacerated kidney.	.....	Lumbar nephrectomy, thirty hours.	Recovery.	.....
24	Wagon-wheel.	Profound shock; bloody urine.	One-third of kidney completely separated.	None.	Lumbar nephrectomy on thirteenth day.	Recovery.	.....
25	Wagon-wheel.	.....	Slight laceration.	Ureter torn.	Primary packing; secondary nephrectomy.	Recovery.	.....
26	Fall six feet.	Severe shock for five days; tumor.	.....	.....	None.	Recovery.	.....
27	.....	.....	Rupture of kidney.	.....	Abdominal nephrectomy.	Recovery.	.....
28	.....	....	Double rupture of kidney.	.....	Abdominal nephrectomy.	Recovery.	.....
29	Fall down hill.	Internal hæmorrhage; bloody urine.	Rupture of kidney.	None.	Lumbar nephrectomy, twelfth day.	Recovery.	....
30	.....	....	Rupture of kidney.	.....	Lumbar nephrectomy immediately.	Recovery.	.....
31	Horse-kick.	Slight shock; abdominal pain.	Rupture and bruise of kidney.	... .	Lumbar drainage immediately.	Recovery.	.....
32	Crushing.	Pain in left side; bloody urine; slight shock; slight dulness in abdomen.	.....	None.	None.	Recovery.	.. ..
33	Wagon-wheel.	Pain in abdomen; no dulness; urine clear.	Rupture on convex border.	None.	Lumbar drainage immediately.	Recovery.	Large hæmatoma around kidney.
34	.....	....	Rupture of right kidney.	None.	Exploratory laparotomy; lumbar drainage.	Recovery.	Intestinal injury suspected.
35*	Horse-kick.	.....	.....	.....	Laparotomy and drainage; lumbar drainage; nephrectomy.	Recovery.	.....

* Author's case.

THE RESULTS OF WOUNDS OF THE LARGE JOINTS MADE BY MODERN MILITARY PROJECTILES.[1]

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THE time has not yet come when any modern observer can give the exact percentages of recovery after conservatism, excision, or amputation for gunshot wounds of the greater articulations received during actual warfare. This is because sufficient data have not as yet been collected and published of the Boer-British war to enable us to make such exact statements as those of our own Civil War, the Spanish-American War, and the Philippine casualties enable us to do. I shall not endeavor to present complete statistics giving the exact number injured by small caliber, large caliber balls or shell fragments, because this would consume much time and no commensurate good would result. Nevertheless, an endeavor will be made to clearly indicate the general principles of treatment involved in the several different classes of gunshot wounds. Although in time more exact percentages may be obtainable, it is doubtful whether the figures will materially alter the statements warranted by the data already at our disposal. These I shall lay before you from the clinical rather than from the statistical side, for none of us will be likely, in an individual case, to be deterred from adopting a course which our experience endorses, by a fractional per cent. greater risk shown by statistics. If the majority of such collections of cases show uniformly better results from one method of

[1] Read before the American Surgical Association, June, 1902.

treatment, unquestionably we should be influenced, but not governed, by such knowledge in determining the proper course to pursue in an individual case.

A study from the clinical rather than from the statistical side is all the more necessary when such statements as the following are still found in a modern text-book in use in most of our American medical schools. While I shall not quote *verbatim*, many of the sentences are word for word as there printed. It is asserted that it matters little whether a joint is traversed by a large ball or a fragment of a shell or merely opened by a fissure extending from a wounded long bone, unless amputation or excision is primarily performed, a suppurative arthritis will develop in from forty-eight to seventy-two hours, quickly proving fatal, although in some instances recovery may ensue after months of suffering with a crippled joint, or only after a secondary resection, or, more often, an amputation.

Let me briefly state the data upon which such statements are founded, emphasizing the fact that they resulted from an exaltation of statistics over clinical observation, which even before 1898 showed conclusively that, however true the conclusions possibly were for the period up to about 1876, they were becoming less reliable with every passing year. Unfortunately, the old views still decidedly tincture modern practice, hence my protest in the shape of this paper.

During the Civil War wounds of the shoulder-joint gave a mortality of 27.5 per cent. under conservative treatment, which was, of course, reserved for the slighter cases; after amputation, 29.1 per cent. died, while the combined mortality of primary, intermediary, and secondary resections was 35.43 per cent., that of the intermediary operation reaching the appalling figures, to the modern military surgeon, of 46 per cent.

The elbow-joint, considering its more superficial position and more favorable anatomical environment, shows not very much better results,—the mortality after expectant treatment being 10.3 per cent.; after excision, 22.4 per cent.; amputa-

tion at the lower third of the arm having a mortality of 20 per cent. The aggregate mortality, after all methods of treatment, was 19 per cent. By expectant treatment the death-rate for wrist-joint wounds was 7.6 per cent., while by all other methods combined the mortality was 25.90 per cent.

From the same source the figures show that conservatism in gunshot wounds of the hip-joint practically meant death, the mortality being given as 98.8 per cent. The combined death-rate of primary, intermediary, and secondary excisions gave somewhat better results, 85.5 per cent. only perishing, while the secondary excisions enable one to give a sigh of relief when we find that only 63.4 per cent. died. The results of amputation at all periods were about the same as for excisions, viz., 89.9; this apparently good showing, however, being due to a not inconsiderable number of reamputations of stumps, since the secondary amputations gave a much higher death-rate (82.5 per cent.) than do secondary excisions (63.4 per cent.). The results during the Franco-Prussian War are not really much more encouraging, thirty-one out of thirty-three wounds of the hip perishing under conservative treatment (*i.e.*, 93.63 per cent.); eighteen out of twenty excisions died (85.7 per cent.), while the eleven subjected to amputation perished (100 per cent.).

Of 432 cases observed during the Civil War, even where no lesion involving the bones constituting the knee-joint existed, ninety-five died, *i.e.*, 21.9 per cent. The ultimate results of forty-four out of fifty-four excisions reported give a death-rate of 81.4, exceeding that of low amputations of the thigh, viz., 53.8.

The Schleswig-Holstein War gave for excisions a mortality of 86.6 per cent.; for those done during the Franco-Prussian War, 80 per cent.; while all died (100 per cent.) during the Russo-Turkish War of 1876 to 1877. Otis reports 133 resections collected from all sources, from civil life as well as military practice, with thirty-five recoveries, a mortality of 73.2 per cent. It would appear that conservatism even then gave a better showing than my text-book quotation would

indicate. Although this treatment would doubtless be employed for the less severe cases, yet of 868 with bone lesions so treated, many of which were serious, only 521 resulted fatally, a death-rate of 60.6 per cent. According to Otis, of 512 wounds of the ankle-joint treated conservatively, 407 recovered and ninety-nine died, a mortality of 19.5 per cent. Of thirty-one excisions where the results were finally determined, twenty-two recovered and nine died, a mortality of 29 per cent.; finally, an average death-rate of 25.1 obtained for amputations performed at all periods. This formidable array of figures superficially scrutinized warrants the pessimistic views quoted. In the light of modern science, a more careful study, however, suggests a rather different conclusion as possible. Although it is true that conservatism was reserved for what were supposed to be the less severe injuries, with the exception of wounds of the hip, the results were so vastly superior to those secured by operation that one cannot but harbor the suspicion that some of the mortality was due to meddlesome surgery, and that a number of cases where primary operations were deemed requisite might have done as well as the slighter cases did, provided the surgeons had not infected the wounds, and free drainage had been secured by the same measures employed in the so-called conservative treatment, *i.e.*, removal of bone fragments after enlargement of the wound.

Before attempting to explain the differing results obtained by the old and the new methods of treating gunshot wounds of the joints, let me give the clinical results secured during the past four years in the United States army. Without going into unnecessary minutiæ, I have found reported 161 wounds of the shoulder-, elbow-, wrist-, hip-, knee-, and ankle-joints, paralleling those quoted in the Civil War statistics. These may seem a small number, but when I state that so far as reported exactly similar results were obtained in South Africa, and when you observe that serious operations were rare, that conservatism—chiefly antiseptic occlusion—and fixation were the rule, and that deaths after both operative and non-operative

treatment were extremely rare, you cannot fail to recognize that my quotation is a most pernicious doctrine, and one absolutely unsupported by modern clinical facts.

Six wounds of the hip-joint gave five recoveries and one death from infection after removal of bullet, fragments of jacket or bones. Sixty-seven cases of knee-joint wounds are reported with but five deaths at the date of publication; two fatal amputations for infection followed the removal of the bullet or some fragments, ten cases in all only apparently demanding extraction of the bullet, fragments of bone or shell. Twenty wounds of the shoulder-joint were followed by two deaths, one after amputation, and in a third case a successful extraction of the bullet was done. Of twenty-five wounds of the ankle-joint two died after amputation, one operation being done for gangrene, and in one other case a bullet was successfully extracted. Thirty-five wounds of the elbow-joint gave but one death, one typical resection being requisite; the bullet or ball and bone fragments were removed in four more, and in three, amputations became later necessary for infection, this almost certainly resulting from previous exploration or operative intervention. Nine wrist-joint wounds were treated without a death and with only one operation, viz., an amputation. No figures are needed to show exact percentages, and these would probably not be accurate, because subsequent deaths or operations may have followed alleged recoveries apparently secured when reported; nevertheless, seven amputations for ball wounds of the knee,- shoulder-, ankle-, and wrist-joints, one resection of the elbow, about a score of removals of bone fragments or bullets, wiring of fragments, etc., with an ascertained mortality of only ten out of a total of 161 cases, speaks for itself. Lest I seem too optimistic, let me quote the experience of Mr. Makins in South Africa. "During the present campaign, direct clean wounds of the joints were little more to be dreaded than uncomplicated wounds of the soft parts alone. No more striking evidence of the aseptic nature of the wounds, and the harmless character of the projectile, as a possible infecting agent, than

that offered by the general course of these injuries in this campaign, is to be found in the whole range of military surgery."

While there are doubtless other factors productive of these changed results, I think the chief ones are the following: First, the practice of many of the Civil War surgeons was unconsciously influenced by the mediæval notion that in some mysterious way gunshot wounds differed from others of the same class, *i.e.*, combined punctured and contused wounds; hence something must be done, and of course something different from that which was indicated for similar wounds produced by other vulnerating bodies than bullets. Then, too, it was deemed most important to ascertain the exact extent of the damage, for unaided nature could not be trusted, but must be assisted by art. The gratification of this knowledge, of course, more often determined infection than relieved it, and the modern methods of drainage were unknown. Finally, the almost unbounded power of repair possessed by the tissues, if left to themselves, has been a modern revelation. In other words, infection by the probe and fingers, additional traumatism still further diminishing the resistance of the tissues, no knowledge of how to successfully combat and render comparatively inert the results of infection, had more to do with the dangers of the older missiles than their form, composition, or the kind of destruction effected. Unquestionably, because the old ball had a low velocity, was large in caliber, and apt to become deformed, it tended to carry fragments of infected clothing, skin, etc., into the wound. Still further, its "energy" was so low that it frequently did not perforate the parts, the "energy" was diverted, and extensive devitalization of the tissues resulted, favoring infection, and the infected foreign body often remained lodged. This was bad enough when true; but often, when the ball had done little or none of these things, the pernicious idea that the ball was in itself a menace to life and health lead to the infection of joints which would otherwise have recovered; the modern gospel, "that a bullet when it has ceased to move has usually

ceased to be harmful," at least primarily, did not seem to be dreamed of.

The lessened morbidity of modern missiles is explainable, first, from their smooth polished surface rendering them poor vehicles for germs, in fact, the jacketed balls have been proven in most cases to be germ-free. Then from their small caliber and smooth surface they almost never carry in with them fragments of infected clothing or skin. Finally, because their velocity is such that perforation is the rule, comparatively little of the "energy" is diverted, unless marked resistance is met with, which cancellous tissue does not present, and the area of devitalized tissue is therefore less than with the old missile, thus rendering infection less likely to occur, and when it does obtain, rendering it not so dangerous; the missile also comparatively rarely lodges.

In brief, the dangers to life, and in a great measure to function, of a wound of any joint is infection. In a certain number of instances undoubtedly the physical destruction of joint surfaces must cause restriction of function. Even with free comminution, however, the subsequent range of motion is often remarkable. Thickening of and adhesions between the soft parts, intra- or extra-capsular, with capsular changes, often does more harm in the way of limitation of movement than does physical alterations of the articular surfaces; and, per contra, with the alteration of joint surfaces such as occurs in closed fractures involving articulations, an eventually good functional result is the rule, if reduction is secured and maintained, unless unusual inflammation occurs. In this connection it must be remembered that displacement of bone fragments by modern balls is very often slight, and that the cancellous extremities of bones are often cleanly perforated, or but slight fissuring occurs. If, then, we can avoid infection, an articulation may be damaged to any extent by a modern small caliber military missile with impunity, so far as life is concerned, and, despite free comminution, in many instances excellent functional results can be secured.

Treatment.—I cannot do better than to preface my own

advice as to treatment by quoting from Mr. Makins's experience of joint wounds, one who speaks from personal knowledge acquired, as my own is, both in civil and in military practice. "The general treatment of the wounded joints was simple. The old difficulties of deciding on partial as against full excision or amputation were never met with by us. We had merely to do our first dressings with care, fix the joint for a short period, and be careful to commence passive movement as soon as the wounds were properly healed, to obtain in the great majority of cases perfect results." Speaking of the knee-joint he says, "The injuries to this joint gave less anxiety and attained a more favorable prognostic character than is the case in civil practice." With a probable or certainly perforating wound of a great joint, whether proven by the course pursued by the ball, bone-dust at the wound of exit, palpation proving fracture, or the X-ray, or with a wound suspected to be a joint one on good anatomical grounds, the proper treatment is most carefully to avoid any examination of the track of the ball, and to thoroughly disinfect the neighboring parts by sterilized soap, nail-brush, alcohol, and chemical germicides. Of course, shaving the area surrounding the parts must be done. An abundant dry antiseptic or aseptic dressing —preferably the former—should be applied, and the joint adequately fixed *until the wound is healed*. Of course, few, if any, of these procedures can be carried out on the field, but antiseptic occlusion by the first-aid package can be done, and some measure of fixation can be secured by one of the makeshifts so familiar to the military surgeon. Where such complications as hæmorrhage from contiguous vessels, the certain or extremely probable lodgement of infected objects, as fragments of clothing, etc., compel an exploration, after the most careful antiseptic preliminaries the wound must be explored, the complications dealt with, and such completely or almost completely separated bone fragments as will necessarily perish if infection follows the intervention, and must then act both as foreign bodies and as obstacles to drainage, should be removed, while all main attached fragments should be replaced,

and either wired or sutured in position. Free drainage must be secured by gauze, preferably by tubes introduced through any required number of incisions into the joint, and fixation made, remembering the great risk to both life and function is pyogenic infection, which is extremely probable after exploration, and that the only efficient means we have to combat infection is, after the primary disinfection, to secure the promptest possible removal of all inflammatory secretions as soon as they are formed. It is almost of equal importance to prevent all movements of the articulation which will mechanically diffuse the infection more widely. Movement also maintains and increases hyperæmia, which in turn impairs the nutrition, and hence the resistance of the tissues, thus often converting a local into a wide-spread infection. When the constituent articular ends of the bones composing a great joint during exploration are found so damaged as to apparently demand formal resection—especially in case of the knee—and where, therefore, the dangers of infection are exceptionally great, amputation will usually prove the better practice. This only more strongly emphasizes the imperative duty of non-interference in wounded joints, unless complications such as hæmorrhage or the lodgement of infected objects demand exploration, because it is almost impossible to secure an aseptic course for the wound when dealing with such large areas of partially devitalized tissues.

But supposing the ball is lodged in the joint? Even in such cases, if uninfected, risk to life is absent, and delay in removal of the missile, unless superficially tangible, will enable the damaged tissues to regain much of their resistance to infective organisms. The fact of its location within or without the joint can also be ascertained by the X-ray, sometimes preventing the performance of an operation on the incorrect diagnosis of an intra-articular missile. I would most earnestly beg surgeons in all cases of suspicious wounds *near* joints which *may* have opened the capsule, to beware of primary exploration, even if the missile be lodged, to fix the joint until the wound heals. When this cannot be done, if possible, post-

pone the extraction of an extra-articular ball at least until the capsular wound has had time to close, otherwise slight, almost latent deep-seated, suppuration may lead to the most disastrous results.

When, however, infection has occurred either from exploration or because of the lodgement of infected materials, what should be done? Unless the general symptoms indicate that no delay is possible, when amputation is demanded, incision with free tube drainage and scrupulous disinfection should be tried, all loose bone fragments or those practically certain to necrose being removed. This will usually succeed with the elbow, often with the shoulder, possibly with the ankle. It will prove the best treatment, I believe, for the hip. Doubtless a transverse incision in front of the knee dividing the patella, with antiseptic packing of the joint after removal with knife, scissors, or curette of all possibly infected soft parts and loose bone fragments, will save a certain number of limbs and lives when infection occurs in cases with slight bone lesions, secondary suturing of the patella being done later. Secondary resection may become requisite for caries or necrosis of fragments. When the local and constitutional evidences of infection increase despite drainage, amputation remains the only resort and should not be delayed. In like manner, secondary hæmorrhage from a main vessel complicating an infected joint-wound would indicate removal of the limb. I have spoken of "nearly certain lodgement of infected fragments of clothing" as a possible indication for exploration, a phrase which needs interpretation. While the majority of military wounds are inflicted by small caliber, jacketed balls, such as the Mauser, Lee-Metford, Krag, and similar weapons project, moving with great velocity, these balls may be deflected by ricochet, or be deformed before wounding; hence they are nearly as likely as the old bullets to carry in fragments of clothing, pieces of shoe leather, or infected skin, especially that of the foot. The character of the external wound will often prove that the missile was deformed or entered more or less sideways, hence has possibly inflicted an infected wound.

Sometimes in such cases, even when examined comparatively soon after the injury, there are clear evidences of commencing infection. Again, soft lead pistol-balls are still employed, blunt and pointed Remington .45 caliber balls, Martini-Henry projectiles, together with the soft lead balls of shrapnel shell may be the vulnerating bodies. All these possess a low velocity; some are apt to become deformed, all tend, when partially spent, if meeting with moderate resistance, to enter more or less sideways, hence are apt to carry in infected materials.

REMOVAL OF THE SUPERIOR CERVICAL GANGLION FOR THE RELIEF OF GLAUCOMA, WITH REPORT OF A CASE.

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PART I.—By C. W. CUTLER.

GLAUCOMA is a disease of a variable nature, at times so subtle and insidious as to escape the trained observer. Again, so emphatic in its traits that the picture impresses one with the facility with which it must be recognized. This protean character brings with it resemblances to other conditions, between which a distinction is of vital importance.

It is natural that such a disease should be left to the specialist where this is possible, but the need of prompt diagnosis and treatment is as urgent as it is in appendicitis or in mastoiditis. Moreover, a recent step in the surgical treatment of the disease has brought it more prominently to general notice, and justifies the attempt to describe some of its more striking features.

Glaucoma is a name given to a group of symptoms dependent on an increase of intraocular tension. The cause of this condition may be obstruction of the normal outlet at the angle of the anterior chamber, or increase of the quantity of

fluid secreted by the ciliary body; beyond this we need not go for the moment into the intricacies of theory. The method used for the determination of increased tension is palpation of the eyeball with the index-fingers through the closed lid, the patient looking downward. It is obvious that small differences may escape the examiner, and, as tension is not constant, frequent examinations, at different times of the day, are necessary.

The results of this increased tension are impairment of function, shown by cloudy vision and narrowing of the field of vision, especially on the nasal side, colored rings or halos around a light, and pain in and around the eye of greater or less severity. This constitutes the prodromal stage, and may occur at intervals of days or weeks before the disease evolves suddenly, after fatigue or excess or excitement. The emotional element is often prominent, pain increases rapidly, vision fails, the pupil is dilated and immobile, the eye injected, the cornea hazy with a dull, steamy surface, the anterior chamber is shallow, the eye is hard to the touch. This attack of inflammatory glaucoma is terribly acute; it has been compared to strangulated hernia, and unless relief is immediate, vision is lost, and the state of absolute glaucoma follows. Between this extreme and the prodromal condition there are various degrees, classified, for convenience, as simple glaucoma, when the tension rises slowly, and is never very high, and as chronic inflammatory glaucoma, when the process is prolonged, but more active than in simple glaucoma. It is convenient to divide glaucoma into two groups, primary and secondary to some other disease of the eye; but the tension and its results are the same in both instances, and it is probable that many cases of so-called primary or idiopathic glaucoma may with care be traced to subtle inflammatory changes, the existence of which is masked by the rapid development of the disease.

The inevitable result of the tension, whether it is slight and transitory or fulminating, is excavation of the optic nerve which furnishes the characteristic ophthalmoscopic feature and leads to the loss of vision.

An important group of cases for the purposes of this paper is that of hæmorrhagic glaucoma in which tension is accompanied or preceded by hæmorrhages in the retina. This occurs in patients with arteriosclerosis or with chronic nephritis. Here the glaucoma is usually acute, and is not, as a rule, amenable to the older method of treatment, as the sudden lowering of tension following iridectomy may have disastrous results.

In another group, classed by some as simple glaucoma, by others as optic atrophy with excavation, the rise of tension is so slight as often to escape the observer; the excavation is not deep, and a positive diagnosis may be impossible except for the occasional subjective symptoms and brief tension after emotional experiences or stress. Such cases are influenced least of all by iridectomy, and are prone to go on to optic atrophy and blindness in spite of all treatment.

The cause of intraocular tension must be sought in diminished excretion or increased secretion of the fluid contents of the eyeball. The theory commonly accepted is that of Knies and Weber. They found that in many glaucomatous eyes the root of the iris is adherent to the sclera, closing the chief channel for the escape of intraocular fluid through the ligamentum pectinatum and canal of Schlemm. This adhesion is probably produced in several ways. Swelling of the ciliary body presses the root of the iris forward so that it is in contact with the sclera. This may be brief and periodic, accounting for the transitory symptoms of the prodromal stage, or it may be complete and permanent, thus producing the severer forms of the disease. Dilatation of the pupil by means of atropine or one of the weaker mydriatics, such as homatropine or cocaine, may induce an attack of glaucoma in eyes predisposed to the disease. This is because the iris, where the sphincter is paralyzed, retracts towards the periphery in folds which tend to fill up the sinus or angle of the anterior chamber.

Priestly-Smith has measured many eyes which have been enucleated for glaucoma. He finds that the lens is relatively

large or the eye small, thus narrowing the passage between the edge of the lens and the ciliary processes through which fluid must pass. Any excess of fluid in the vitreous, then, or any increase in its density, hindered in its normal channel, will press the lens, ciliary processes, and iris forward and close the exit. Panas and Rochon-Duvigneaud ("Sur le Glaucome," Paris, 1899) believe that the first step in the process is an œdema of the vitreous resulting from the vascular degeneration which they found in glaucomatous eyes.

It is clear that if the ciliary body secretes too much fluid, the same end is reached; and the earlier theories of von Graefe and Donders were akin to this assumption, and Laqueur (*Deutsches Archiv für klinische Medicin*) has returned to the view that the origin of the disease is a secretory neurosis of the sympathetic system.

It is not probable that changes in blood-pressure have any direct influence on intraocular pressure, but senile changes in the vascular walls, arteriosclerosis, and obliterating endarteritis are found in a great many eyes enucleated for glaucoma, and are believed to have an important influence on the disease, and especially on the excavation and atrophy of the optic nerve.

It must be noted that there are very few opportunities for the pathological examination of eyes in a state of acute glaucoma, and there is no conclusive evidence that the obstruction in the anterior chamber and the vascular changes are primary and causal.

It is obvious that the mechanical obstruction of the outlet must dam back the current, and in secondary glaucoma this is cause enough for the clinical picture; but primary glaucoma is another matter, and suggests very forcibly the existence of a nerve mechanism governing the relations of the walls of the eyeball to its fluid contents, controlling the intake and outlet, and the tone of the muscular walls as we assume must be the case, although positive proof is lacking there also, in the vasomotor mechanism and in other hollow viscera.

That retention of the contents of the eye must cause glaucoma has been proven (if it was not self-evident) by numerous experiments on the eyes of rabbits by Bentzen (*Archiv für Ophthalmologie*, Band xli, 4, Abt.), and by Koster (*Archiv für Ophthalmologie*, Band xli, 2, Abt., also in Lubarsch and Ostertag, Ergebnisse der allgemeinen Pathologie des Auges, 1901); but that this condition is the only cause, or, in primary glaucoma, the origin of the disease, is by no means proven, and is a matter much more difficult to investigate.

For nearly fifty years, since von Graefe described the operation (*Archiv für Ophthalmologie*, Band iii, 2. Abt.), iridectomy has been practised, and it is still the only measure offering relief in certain cases. Notwithstanding this long period, men of large experience are still at variance not only as to the way in which the operation acts,—for the theory is almost as obscure as it was in von Graefe's day,—but as to its efficacy in certain cases, especially of simple glaucoma.

It is impossible to do more in this place than to state very briefly the case for and against iridectomy in order that an idea may be had as to the prognosis.

In acute inflammatory glaucoma the results are best. Haab ("Das Glaucom und seine Behandlung," 1902) gives the results of iridectomy in thirty-one eyes observed for two years or more: seven became blind, 22 per cent.; four cured relatively, 13 per cent.; twenty cured completely, 64 per cent.

Of thirty-seven eyes with chronic inflammatory glaucoma, sixteen became blind, 43 per cent.; ten were cured relatively, 27 per cent., and eleven were cured completely, 30 per cent.

Of seventy-six eyes with simple glaucoma, twenty-two became blind, 29 per cent.; twenty-two were cured relatively, 29 per cent., and thirty-two were cured completely, 42 per cent.

Of ten eyes with hæmorrhagic glaucoma, six became blind and four were improved.

Of fifteen eyes treated only with drugs (eserine and pilocarpine), nine were blind and six relatively helped.

By relative cure, Haab means that useful vision was retained, in spite of relapses, by the use of eserine or pilocarpine or by a later sclerotomy. These statistics may be taken as representing the average of a number of observers, although there are wide limits.

It is now necessary to turn from this very superficial review to a consideration of the latest claimant.

It is much too early to attempt to compare sympathectomy with iridectomy. The cases now watched with more or less enthusiasm must be allowed to stand the criticism of at least two years' impartial observation before definite conclusions can be reached. The following record is offered, then, as a basis for future study.

The history begins April 30, 1897. A. G. R., aged fifty-six years; several members of his family became blind from unknown causes. The patient has had muscular rheumatism and pains in and around the joints without signs of acute inflammation for years, and has suffered much with neuralgic pains in the face. There is marked arteriosclerosis; the heart and kidneys are normal.

In 1893, at the homœopathic hospital, he was given some medicine for hiccough, and soon after had severe pain in both eyes. Vision was much impaired, and everything seemed colored red. This lasted two days, and sight returned gradually. For the past year and a half attacks of cloudy vision have been frequent, with rings around the lights and more or less pain. For about a year, chromatopsia has been very frequent and distressing.

The predominant colors are red, orange, and violet, in that order. These colors remain, after looking at objects of the same color, as persistent after-images. Blue seems to leave a violet after-image. When the eyes are closed he often sees orange or red; he formerly saw all colors but blue. He distinguishes plainly between these bright colors and the dull rings seen around lights. At times red or orange seems to break like a rocket, as he expresses it. Again it would settle gradually on what he was looking at, blotting it out with a clear, beautiful color, not in the least foggy, or there might be a fog without color. It did not seem that red vision followed fatigue with one color more than another.

Often it would come after a perimetric examination with a white object, suffusing the entire field, and at times it is present on awakening from sleep or in a dark room. Yellow and green do not seem to have been noticed. In relative scotomata and at the edges of absolute scotomata and the margins of the field where vision is variable, the test object, white or colored, is seen red.

These phenomena were lessened by eserine and pilocarpine, and after sclerotomy they disappeared for a time. Later, they reappeared. Now, since the sympathectomy, the subjective sensations are absent, although the red edges of scotomata in the field are constant. Color perception is normal. Night-blindness has been a prominent symptom. Improvement with adaptation has been comparatively slight; continued reading was at his best times almost impossible, the retina quickly becoming fatigued.

Perception of least differences is considerably below the normal, and at times day-blindness is marked, as would be expected from the condition of the optic nerve.

Usually the eyes are staring, and the upper lids are retracted, so that the entire cornea is exposed.

At the time of the first examination, April 30, 1897, vision in both eyes = $^{20}/_{100}$, tension + 1, pupils normal, reacting to light, anterior chamber and iris normal, media clear, retina normal in appearance, vessels very slightly narrowed, nerves excavated to a depth of about 3 D, vessels lost at the edge to reappear at the floor; there is no apparent difference in the excavation at different parts of the nerve to account for the loss of the upper part of the field.

May 2, after eserine had been used for three days, vision, R. E. = $^{20}/_{30}$, L. E. = $^{20}/_{40}$. Tension normal in both eyes. This continued under eserine or pilocarpine for nearly two months, when vision began to fail rapidly, varying from $^{20}/_{40}$ to $^{20}/_{100}$. At times tension slightly raised, more often normal.

Anterior sclerotomy was performed and vision became $^{20}/_{20}$ in both eyes, and remained so with some fluctuations for nearly three months, when the sight failed more rapidly than before, and on December 29, 1897, vision was $^{15}/_{200}$ in the right eye and $^{10}/_{200}$ in the left. On January 6, 1898, iridectomy was performed on the right eye. The operation and recovery were uneventful, and vision improved somewhat, but not enough to encourage the patient to submit to an operation on the left eye.

The hospital records of this period are unfortunately lost; but shortly after this he disappeared, and was not seen again until June of last year.

June 2, 1901. R. E., fingers at three feet, tension + ½ to + 1; L. E., absolute glaucoma; V. 0, tension + 2.

June 5. After eserine for three days, V. R. E. = $^{20}/_{200}$ +. The fields of vision at different periods may be seen better than described. Pain constant and severe in both eyes. Appearance of nerves and vessels much the same as previously noted. In the left eye the lens was sclerosed.

The superior cervical ganglion of the right sympathetic was excised at St. Luke's Hospital, June 10, 1901. During the operation there was no noticeable dilatation of the pupil on excitation of the ganglion, nor was there any change when it was divided.

June 11. Right pupil slightly contracted, reacts to light, much hyperæsthesia of skin of face and pain on pressure in both eyes, especially the right. Conjunctiva congested, photophobia marked, probably due to the ether. Flashes of red light in right eye.

June 12. R. E. Tension — ½, vision $^{20}/_{30}$. Field of vision larger than before the operation, slight ptosis, some difficulty in swallowing, choking sensation, pain in right side of face and head, impaired phonation.

June 19. Vision, R. E. $^{20}/_{30}$ +, Tn. Ptosis of right lid, retraction of left lid, sweating only on left side of face, slight right enophthalmus. The right optic nerve seems less pale than before the operation.

November 18. Since leaving the hospital, vision has remained the same, $^{20}/_{30}$ +, at repeated examinations, with different test types and under varied conditions. About three weeks ago a few letters of $^{20}/_{20}$ were read. To-day vision is $^{20}/_{30}$, full. Ptosis less marked.

May, 1902. Nearly a year after the operation, vision remains $^{20}/_{30}$. He reads an hour quite easily, and thinks he could read more, but prudently stops before he is fatigued.

August 25.—Vision $^{20}/_{30}$; reads fine print easily. The field is narrower, especially for red, showing that the optic nerve is becoming more atrophic.

The secondary effects of the operation were paralysis of the

right side of the larynx, the sternomastoid, trapezius, and the right half of the tongue; reaction of degeneration was present. This condition gradually diminished, so that four months after the operation little or no discomfort was experienced, and now there are no signs of the nerve lesions except some paræsthesia of the side of face and neck and occasional sharp pain in the temporomaxillary articulation or the parotid on beginning to masticate, and on taking acid substances into the mouth.

The examination of the excised ganglion by Dr. Wood, pathologist to the hospital, is as follows:

Specimen, five centimetres long, one-half centimetre in diameter. At one point, for one and one-half centimetres, is a thickening. Sections through whole length of specimen show large ganglion cells. In these cells the chromophilic bodies do not show the normal size and arrangement, and many cells show small granules of pigment. A growth of connective tissue is between the ganglion cells. Nerve fibres are normal.

It is evident that if glaucoma is relieved by removal of the ganglion, the hypothetical process active as a factor in the etiology must be of a chronic irritative nature, or it may be considered an exaggeration of the physiological function. Sclerosis of the ganglion with the formation of new connective tissue might act in this way by compressing the ganglion cells in its contraction, but the objection occurs at once: If this is true, why is glaucoma not more common, since sclerosis and the deposit of pigment in the ganglion cells seem to be a frequent occurrence in arteriosclerosis and senile conditions in general? (Graupner, *Ziegler's Beiträge*, xxiv, p. 253.)

The literature of this subject has become so extensive that a brief allusion to it must suffice. A complete list of cases reported would serve no useful purpose, as the information most desired will be obtained only from the later reports of these cases, and not from an announcement of operations performed. We have had recourse chiefly to Ziehe and Axenfeld's excellent monograph, "Sympathicus-Resection beim Glaucom." Marple has tabulated these cases concisely, with some more recent reports, in an article to which reference should be made.

The conclusions of Ziehe and Axenfeld, while conservative, are by no means unfavorable.

In four cases of acute inflammatory glaucoma, the results of the operation were negative. Iridectomy is much to be preferred in these cases.

Of three cases of hæmorrhagic glaucoma, Abadie's was blind, pain and tension were relieved. In Dor's case, glaucoma followed three attacks of serous iritis. After iridectomy, there were two severe intraocular hæmorrhages. A month later the ganglion was excised, and rapid improvement of tension and vision followed. During the three and one-half months' period of observation there was another light attack of inflammatory glaucoma. In the third case (Albertotti) the record is so confused that definite conclusions cannot be drawn Pain seems to have been relieved, but tension became high again after one year and a quarter. In the second eye of the same case, sympathectomy was evidently performed as a prophylactic measure. The eye remained normal.

Among seventeen cases of chronic inflammatory glaucoma, eight were absolute. Pain and tension were relieved in three of these; of the remaining cases, five showed a distinct gain. In one (Demicheri), vision arose from $^1/_{50}$ to $^2/_3$; iridectomy had been ineffectual; in one eye there was absolute glaucoma, in the other high tension and distinctly atrophic spots in the iris; the field of vision was limited upward and outward. After sympathectomy, vision became $^2/_3$, field of vision and tension became normal, and remained so during three months' observation. The atrophic spots in the iris disappeared.

With the exception of the last surprising statement, this case, in its history and degree of improvement, resembles the one forming the basis of this article.

Of simple glaucoma, thirty cases are given, and eighteen of these may be said to have shown improvement, in some instances very marked, extending over periods of several months to a year, in others less brilliant and for varying times. Often the time of observation has been so brief that the records

are valueless as yet. In four cases the disease advanced inexorably, not because of the operation, however, but in spite of it. It is, however, in desperate cases, as a forlorn hope and especially where iridectomy has failed, that sympathectomy deserves consideration; and as it is has been done chiefly in such cases, it is not just to compare the results with those following iridectomy, which is or should be performed at an early stage of the disease. In a recent article by Rohmer (*Annales d'Oculistique,* May, 1902), 114 cases, from various sources, are reported. The figures are distinctly favorable but by no means conclusive.

The risk is very slight; there have been no deaths, and the early secondary effects are temporary and avoidable. With regard to the late secondary effects we have little information.

In a table given by Wilbrand and Saenger ("Neurologie des Auges," Vol. i, p. 546), ten cases of sympathetic paralysis following wounds show four with trophic disturbances, the cheek being shrunken (*abgemagert*). Three of these cases, seen seven, nine, and ten years after the accident, still showed ptosis and narrowed pupil. This would indicate that the effect of the operation on glaucoma may also be of long duration.

In passing, a symptom may be mentioned, which, if proven to exist in certain cases of glaucoma, will help to distinguish such cases as are dependent on the influence of the sympathetic ganglion. We refer to retraction of the lids or von Graefe's sign, which in three cases of chronic glaucoma seen recently has been more marked than is usual in optic atrophy or impaired vision from other causes. It does not seem amiss to associate this symptom with the large, sluggish pupil and increased tension of glaucoma, since all are influenced by sympathectomy. In one case of unilateral glaucoma this sign is present only on the affected side. It is not as pronounced as it often is in Basedow's disease, but resembles the effects of cocaine. Von Graefe's sign is sometimes seen where there is no disease, and in normal eyes and in these cases it may be merely a result of the effort to see better, but the case in which

it is present only on the side of the glaucoma is certainly suggestive.

Our case has not been one in which brilliant results might have been expected. All other measures had failed to give more than temporary relief. The appearance of the optic nerve was such that vision seemed compromised from causes secondary to the glaucoma. Its pallor and the total excavation gave little hope. The retinal vessels, however, were not notably contracted, and this fact may explain one of the ways in which sympathectomy acts—by improving the nutrition of the retina and nerve when the vessels are not irredeemably reduced.

The question suggests itself, whether the passive hyperæmia following vasomotor paralysis is of value to the tissues; but this is a point that must be left to the physiologist.

The increased vitality of the retina and nerve was shown by the disappearance of the distressing color sensations and after-images. The diminished pallor of the nerve seen by Ball and by Schmidt-Rimpler in a case of Basedow's disease and in our own case is striking, and makes it easier to accept the improvement claimed in a few cases of atrophy of the nerve not of glaucomatous origin. Such improvement, however, must be of brief duration and not sufficient to justify the operation.

Paralysis of the sympathetic also narrows the pupil, thus freeing the angle so often mentioned; besides this, it unquestionably softens the eyeball, even in the normal state, quite independently of its action on the pupil, in a way not yet understood.

It is apparent that glaucoma is a complex disease, not traceable to any single cause, and that excision of the sympathetic ganglion is a physiological antagonist to its most important symptoms. Whether this will be supported by clinical evidence in any number of cases, or whether the results will be of sufficient duration to justify the operation, only time will decide.

PART II.—By C. L. GIBSON.

On June 10, 1901, I removed the upper ganglion of the cervical sympathetic. Nitrous oxide and ether anæsthesia. Usual asepsis, including the use of rubber gloves. A straight incision running downward from the mastoid along the anterior border of the sternomastoid. The sheath of the vessels having been exposed, the vessels and pneumogastric nerve were reflected inward, and after some further dissection the sympathetic ganglion was found posterior to the aforementioned structures. A painstaking dissection of the connections of the ganglion was made before division of the nerve above and below. The wound was sutured without drainage and healed *per primam*. Convalescence was uneventful. He was allowed up on the ninth day, and discharged ten days later. Although the operation presents no extraordinary difficulties, several points are of interest.

In the hands of a competent surgeon familiar with work in this region of the body, it is a comparatively safe operation to perform on a patient who is in a fair condition of health. It is desirable to secure perfect aseptic conditions, for a failure of technique might involve considerable danger of septic infiltration in the deep planes of the neck.

The incision employed seems to me to give an admirable *exposé* of the field, and is to be preferred to that employed by Jonnesco and other European surgeons, that is parallel to the posterior border of the sternomastoid. A clear view is absolutely necessary; a suitable electric headlight may prove useful. I also found that a frequent douching of the wound with normal saline solution useful in restoring the identity of the structures when discolored with blood.

In subsequent operations, I shall not attempt to make so minute a dissection of the communicating nerves radiating from the ganglion, as it seems quite unnecessary, and subjects these filaments to unnecessary traumatism, which resulted in our case in transitory pareses of the pharynx, larynx, and tongue. There was also a temporary paresis of the trapezius;

this was caused, as we realized during the operation, by pressure of a retractor upon the spinal accessory.

It seems likely that these various disturbances that have also frequently been noted by other operators are caused by this direct violence of the neighboring nerves or communicating filaments rather than to interference with some of the physiological functions of the ganglion.

On the other hand, careful observation of the after effects of these operations may yield additional information to our rather vague understanding of the essential functions of the sympathetic ganglion.

The names of several individuals, Baracz, Abadie, Jaboulay, and Jonnesco, are identified with the evolution of the idea of attacking the cervical sympathetic by its section, or by its extirpation for the relief of glaucoma. To the latter we apparently owe the idea of the *removal* of the upper cervical ganglion, which he seems to have developed as a result of his original treatment of epilepsy by the removal of the entire cervical sympathetic on both sides.

His early recommendations (*Centralblatt für Chirurgie*, 1899, page 161) received only scant notice or sharp criticism, more particularly as they were presented in a manner that failed to inspire confidence. In the course of time cases were published from sources deserving of every respect, which tended to give the operation a certain standing. In New York conservatism was extreme, and many oculists were reluctant to yield to the persuasion of surgeons to whom this operation as published in the surgical literature had been known for some time. The case we have reported and one performed just before by Dr. Frank Hartley were, I believe, the first performed in this city. Quite recently, however, they have been performed frequently both by oculists and surgeons, and further valuable experience is to be expected. My own belief is that sympathectomy is destined to occupy a definite place in the treatment of this distressing condition, but its proper sphere is to be determined by the judgment of the ophthalmic surgeon.

To summarize our conclusions, it may be stated that in acute forms of glaucoma iridectomy must be considered the operation of choice, except where there is a tendency to intra-ocular hæmorrhage. In all chronic forms of the disease, the improvement to be expected from iridectomy is less, as the tension of the eye is less marked, until in simple glaucoma the results of the operation are at the most 50 per cent. of successes, while in the group of cases mentioned above, on the border-line between glaucoma and optic atrophy, iridectomy is of so little value that it has been given up by many ophthalmic surgeons.

In these cases, in hæmorrhagic glaucoma and in not a few cases where iridectomy has failed to give relief or has done positive injury in the first eye, sympathectomy may prove to be the more conservative operation, especially as there is no evidence to show that the removal of the superior cervical ganglion of the sympathetic has resulted in any injury to the human eye.

This case may be an exceptional one, but an operation that has such definite results, in even a limited number of cases, cannot be thought of lightly, and must be accepted as an important additional resource in a desperate condition.

NOTE ON SYNCHRONOUS LIGATION OF BOTH INTERNAL JUGULAR VEINS.

By J. F. BALDWIN, M.D.,

OF COLUMBUS, OHIO,

SURGEON TO GRANT HOSPITAL.

Mrs. J. C. B., of Columbus, Ohio; aged thirty years; married four years. Number of children, two; younger, two months; has had tuberculosis of the glands of the neck for a number of years; was operated on by a Michigan surgeon five years ago, a small tumor being removed from the left side of the neck. A year later was operated upon again by a Canadian surgeon, who removed a small tumor from the same side. In February, 1899, was operated upon by a prominent Omaha surgeon, who removed a large amount of glandular tissue from each side. The patient states that what was removed would have filled a quart cup. In August of that year was operated upon again by the same surgeon, who removed small growths from each side. In March, 1901, he operated again upon both sides, removing, as the patient states, another quart of tissue.

She consulted me in November, 1901. At that time there were large masses upon each side. The patient was far advanced in pregnancy, and it seemed undesirable to make as serious an operation as would be necessary to effect complete removal. Accordingly, a few especially painful nodules were removed under cocaine. She was confined at full term in Canada, and returned here for operation in April, 1902. At that time the masses were materially larger than in November. They extended far beyond the line of the jaws and involved much more than the field of previous operations. In addition to the lateral masses there were two glands in the median line above the hyoid bone. On the right side the mass was almost immovable, but a good deal of motion could be obtained on the left side, and the glands under the chin were freely movable. Both parotids were in part involved.

Patient was operated on at Grant Hospital, April 11. Ether was given by Dr. C. M. Shepard, and my assistants were Dr. S. J. Goodman and student Bowen. As the mass on the right side presented the greater difficulties, this was first attacked. A free incision was made, followed by a careful dissection of the entire region. With difficulty the affected parts were separated from the healthy tissue and lifted up from the deeper structures. It was then found that the mass was closely adherent to the deep cervical vessels. The diseased tissue was carefully separated with fingers and sponge, aided as needed by scissors, but suddenly the internal jugular vein was opened. This accident had been feared, and hæmorrhage was instantly checked by sponge pressure and the enucleation completed. Examination then showed quite a large opening in the vein. A ligature was therefore applied above and below and the cavity packed for the control of the oozing. The glands under the chin were next removed without difficulty and the incision closed without drainage. Careful examination of the tissue on the left side led to the hope that the operation here would be much easier than it had been on the right. The patient had complained bitterly of all the glands being exceedingly painful, and her last words had been an expression of hope that all could be removed. The same procedure was therefore instituted on this side as on the other, and after a careful dissection the entire mass was finally separated, except at its inner side. This surface was separated without any special difficulty until a mass about the size of a hen's egg was encountered, which extended deeply down into the neck and was attached, as on the opposite side, to the great vessels. Separation was here proceeded with with the utmost caution, but in spite of every care the jugular was opened. At the same instant that it was opened the patient made an inspiratory effort, and the hissing of the air was heard as it was drawn into the vein. This was but for a single instant, however, as a sponge was at once pressed upon the opening. We then waited for a few moments to see if any ill effect would follow the inspiration of the air or the interference with the return of blood through the vein. No disturbance of any kind could be noticed, but pulse and respiration continued precisely as before. The rest of the mass was, therefore, enucleated and a double ligature applied to the vein. Both cavities were of enormous size, and were lightly packed with gauze, with suture of the

incisions to the lower angles. Patient bore the operation remarkably well, and was put to bed in excellent condition.

I personally superintended the dressing on the third day, as I wished to remove the gauze packing. Patient was feeling well, and said that she could sit up to have the dressings applied. Just at the completion of the dressing she said that she felt she must lie down, and I at once eased her back onto her pillows. She was immediately seized with a general but not very violent convulsion, which probably lasted twenty seconds. Consciousness was recovered immediately, and, with a smile, she assured me that she was all right. Recovery was uneventful, and she left the hospital in two weks. The only evidence of any interference with the circulation has been a little puffiness of the face.

While in my previous experience I have in several instances been obliged to ligate one internal jugular, I have never before had occasion to ligate both. Indeed, the necessity for such a synchronous ligation must be exceedingly rare. In the literature at my disposal I have not been able to find a report of any such ligation. That profound central disturbances were not produced by such an interference with the cerebral circulation was to me a matter of considerable surprise. The vessels were of the ordinary size; but I suspect the long-continued pressure of the surrounding tissues had so far interfered with the return of blood through these channels that a fairly satisfactory collateral circulation had already been established.

OPERATIVE TREATMENT OF EXOPHTHALMIC GOITRE.

By EMMET RIXFORD, M.D.,

OF SAN FRANCISCO, CAL.

In reporting the following two cases of exophthalmic goitre, it is not proposed to draw from them any very broad generalizations, but to bring forward whatever of interest they possess, in the hope that in a subject where the indications for surgical interference are still indefinite even such isolated observations may be of value. Individually, the cases present some unusual features worthy of note, which shall be the writer's excuse for reporting them in detail: the one, the development of severe Basedow symptoms after a course of thyroid extract, a rapid development of a cyst in the remaining half of the gland after a unilateral thyroidectomy, with recurrence of the nervous symptoms, transitory myxœdema after a second operation, with eventual relief; the other presenting universal non-pitting œdema unaffected by a short administration of thyroid extract, by which, however, the nervous symptoms were markedly increased, the whole clinical complex being altered and relieved by enucleation of a large encapsulated thyroid adenoma. In both cases the symptoms of Graves's disease were secondary to the appearance of the goitre.

If a word may be said of the operative treatment of exophthalmic goitre in general, and the indications for its employment, the following is offered as representing the consensus of opinion of the more broadly conservative surgeons at the present time, viz., that, with the obvious exception of the few cases in which the indications for operation are absolute (as when the tumor produces dangerous compression of the trachea), patients suffering from exophthalmic goitre

should be subjected to operation only after reasonable trial of medical treatment has been made and failed. However, as knowledge of the relation of the goitre to the symptoms increases and the technique of operation is developed, the limits of usefulness of operation will be better determined, and it is probable that a larger and larger proportion of cases will be successfully treated surgically. At least a review of the literature of the subject of the last few years seems to warrant that expectation. The reason for this conservative position of surgery at the present time is, in addition to recognition of the real value of medical treatment, in which should be included mental and bodily rest, the universal experience that operation on patients suffering with exophthalmic goitre is attended with grave danger. Furthermore, it has been shown that this danger is especially great in acute cases, and somewhat in proportion to the severity of the nervous symptoms. It would seem, then, that operation is pretty definitely contraindicated in severely acute cases and in acute exacerbations of chronic cases. Since acute attacks of exophthalmic goitre have many times been reported as having followed severe nervous shock of mental strain, and since it is commonly found that severe strain, mental or physical, will increase the nervous symptoms in most cases of exophthalmic goitre, it is reasonable to suppose that the inevitable mental excitement attendant upon undergoing a serious surgical operation is in itself enough to greatly aggravate the nervous symptoms. For this reason, when operation is proposed in a given case, it is advised to choose for the time of operation a period of quiescence rather than to operate during an exacerbation of the nervous symptoms. To the same end, in an acute case, some advantage may be gained by taking time to prepare the patient for operation by a period of as complete physiological rest as possible. The heart should be carefully studied, and operation not deferred too long in cases where the heart action grows progressively weaker.

The anæsthetic further adds to the danger. In fact, Kocher looks upon the anæsthetic as the greatest danger in

operation in such cases. Under the anæsthetic the rapidity of the heart action is further increased, and often to an alarming extent. Some years ago the writer gave the anæsthetic in an operation by Dr. Lane, of San Francisco, of enucleation of a cystic goitre with signs of Graves's disease, though without noticeable exophthalmos. Billroth's A. C. E. mixture was used, but sparingly, however, for the patient was greatly depressed by it, and the pulse-rate, which had been about 120, rapidly increased to 140, which it maintained throughout the operation. Within twenty-four hours it had increased to 180, and soon to 200 and 260. The heart finally beat itself out, and the patient died within forty-eight hours of the time of the operation. Because of the danger of general anæsthesia, Kocher operates with no other anæsthetic than a small injection of cocaine into the skin, claiming that little pain is caused by the work in the deeper tissues.

Depending comparatively little on what operation is done, the symptomatic rapidity of heart action is invariably increased even independently of the anæsthetic. By those who follow the theory of Moebius of hyperthyroidism, this exaggeration of the nervous symptoms following operation is usually accounted for by supposing that the manipulation of the gland sets free a large amount of thyroid secretion which finds it way into the circulation. In both the cases here reported operation was followed by marked exaggeration of the tachycardia, the tremor and the sweating, although no anæsthetic was used beyond a few minims of a weak solution of cocaine in the skin.

It is on this ground that attempts have been made to destroy portions of the thyroid gland with a minimum of manipulation such as Jaboulay's exothyropexie, an operation which has not given satisfactory results, and which one would suppose to be extremely dangerous from inevitable infection, against which patients suffering with exophthalmic goitre have very little resistance. Ligation of the thyroid arteries, formerly done by Wölfler in ordinary goitre, has been revived and applied to exophthalmic goitre, and is being done by Kocher

and others for the purpose of causing atrophy of the gland. It has been found that ligation of one artery is not sufficient to produce any marked effect, and to ligate all four of the main arteries while it does not produce gangrene of the thyroid is apt to be followed by myxœdema. From a technical stand-point, it is difficult to see that the ligation of both superior and one inferior thyroid arteries is a much simpler operation than partial thyroidectomy, and it must entail more or less manipulation of the gland.

The operations on the cervical sympathetic nerves as performed chiefly by Jaboulay and Jonnesco have not met with very wide-spread favor. Although a number of apparently successful cases have been reported, they are too few to be the basis of final verdict in regard to the value of the procedure. The operation of Jonnesco, in which the greater part of the cervical sympathetic is removed with the third ganglion, is attended with serious technical difficulties. The operation seems to have its greatest usefulness in lessening the exophthalmos; and some have suggested that the diminution in the size of the goitre as reported may possibly be accounted for by ligation of the vessels in the dissection (Freiherr v. Eiselsberg), but cases have been reported where the operation has been performed through an incision posterior to the sterno-cleidomastoid muscle, which would be completely posterior to the vessels. Mariani, who reports a remarkably favorable result from the bilateral operation, looks upon the procedure not as attacking the primary seat of the disease, but as purely symptomatic in destroying a portion of the mechanism by which certain symptoms of the disease are produced.

By far the greater number of surgeons reporting results of operation in exophthalmic goitre favor the operation of partial thyroidectomy. Mikulicz would consider it the normal procedure, to be modified according to the peculiarities of individual cases. The results of partial thyroidectomy have materially improved in later statistics, largely by reason of the more intelligent selection of cases, selection of favorable moment for operation, the abolition of general anæsthetic and

avoidance of undue manipulation of the gland, and, as advised by Moebius, division of the isthmus with thermocautery or searing the cut surface. Starr's statistics, 1896, of 190 cases showed a mortality of 12 per cent.; Kinnicutt's of the same year, 187 cases, with mortality of 7 per cent., and Rehn's, 1899, 13.6 per cent., with mortality, after ligation, of 48 per cent. Several reports of considerable series have been made in the last two years which are much more favorable. Schulz (*Beiträge zur klinischen Chirurgie,* Band xxx) reports twenty cases of partial thyroidectomy (including enucleation of adenomata) without a death, although chloroform was used. Of these eighteen were traced, and all but one were either cured or very greatly improved, although fourteen were bad cases. Wilmer (*Beiträge zur klinischen Chirurgie,* Band xxix) reports twenty-three cases of exophthalmic goitre treated by operation, nineteen being resections, three enucleations, and two ligations of the thyroid vessels with two deaths. All were followed but one. In eighteen the result was satisfactory, and there were two failures. Reinbach (*Mittheilungen aus dem Grenzgebiet der Medicin und Chirurgie,* Band vi), studying eighteen cases operated on by Mikulicz, reports twenty-one operations, sixteen being resections without a death, and five ligations with one death. Of the eighteen cases twelve were completely cured, nine being traced from four to nine years, and three more than one year, and three cases were greatly improved. In only one case was there a recurrence. Taking these three groups of cases of operation on the thyroid together, there are sixty-five operations (resections, enucleations, and ligations of vessels) with three deaths,—a percentage of 4.6 per cent. Fifty-eight patients were traced, of whom forty-seven (81 per cent.) were cured or had satisfactory result, three were improved, and four (7 per cent.) failures or had recurrence.

In 230 cases of partial thyroidectomy collected by Ehrhardt (*Handbuch der praktischen Chirurgie,* 1900), 45 per cent. were cured, 23 per cent. greatly improved, 11 per cent. slight improvement, in 10 per cent. failures, and in 7.5 per

cent. deaths. The cases were not separated into genuine and secondary forms, and the results are no improvement on older statistics.

Since the above was written, an elaborate article on the subject of the operative treatment of exophthalmic goitre has been published by Dr. Albert Kocher (*Mittheilungen aus dem Grenzgebeit der Medicin und Chirurgie*, 1902), in which a most painstaking review is made of all the cases occurring in Professor Kocher's clinic in Bern. The report gives in detail the histories of ninety-three cases: fifty-nine were operated on, of which thirty-seven were severe and twenty-two moderately severe cases or with one or more symptoms lacking. Forty-five, or 76 per cent., remained cured; eight, or 14 per cent., were definitely improved; two, or 3.3 per cent., slightly improved, and four, or 6.7 per cent., died. On the basis of the results of operation in these fifty-nine cases, Kocher makes a strong plea for the operative treatment of exophthalmic goitre.

Case I.—Miss M. A., aged thirty-one years, entered hospital January 4, 1900. Her mother, aged sixty-one years, had had a large cystic goitre since girlhood, but with no Basedow symptoms beyond general nervousness and insomnia. This cyst was ruptured by a fall, and the fluid was absorbed and did not reaccumulate. Patient's grandmother on her father's side had goitre. Patient's goitre was first noticed when she was twelve years of age. It continuously increased in size, slowly at first, rapidly during the last seven years. About 1892 patient began to be troubled with shortness of breath. In 1895 had an attack thought to be dysentery. In 1897 she weighed 145 pounds, and was advised to try thyroid extract for the goitre. She took five grains twice daily in periods of two weeks at two weeks' intervals for some months. The weight steadily decreased at the rate of five pounds a month until she weighed 115 pounds, the goitre remaining unchanged. She was given fucus vesiculosus, and then potassium iodide in large doses, with no beneficial effects. Beginning in 1895, she had had paroxysms of severe pain in the right side in the region of the liver, gradually increasing in frequency and severity and duration, coming on chiefly at night. In these attacks, the pain

would be preceded by a period of increased cardiac activity and shortness of breath. The pain would begin as a dull ache, and gradually reach a maximum, radiating over the abdomen, back, and right shoulder, and slowly subside, leaving the right side sore and tender. Jaundice was never observed. In 1899, following prolonged over-work, these attacks became so frequent and severe that she was obliged to give up her work. The condition improved for a time under complete rest, but the attacks recurred with increased severity. Vomiting and excessive perspiration were added. There was no disorder of menstruation beyond pain. She had for years very little use of her voice beyond the needs of conversation, and for two years was unable to make more than slight physical effort without great shortness of breath. She was sent to the writer by Dr. W. F. Cheney, of San Francisco, for operation, he having made the diagnosis of Graves's disease with compression of the trachea. This latter gave absolute indication for operation, and the occurrence of a paroxysm of pain of unusual severity, lasting four days, during which her parents all but despaired of her life, decided the matter with the patient.

Status.—Slight young woman, weighing 100 pounds, presented nearly uniform enlargement of the thyroid, the left side a little larger and extending into the ring of the first rib; dyspnœa considerable, even at rest; respiration noisy from stenosis. Pressure on the tumor caused almost complete closure of the trachea. The goitre was moderately firm in consistency; no cyst or localized tumor definable, no observable pulsation, moving about three centimetres on deglutition. Patient excessively nervous, restless, with marked tremor, very little exophthalmos (the lid aperture slightly larger than usual). Pulse-rate while at rest in bed, 124 to 130; temperature, 99 to 100.4° F.; pain so great as to prohibit sleep and to require morphine. No jaundice present. Stools normal in color. Entire liver region tender on pressure, moderate spasm of upper abdominal muscles, liver dulness, nine centimetres in mammary line, not extending beyond border of ribs. Under rest in bed for a few days, pulse came down gradually till it ranged from 80 to 100, and the hepatic pain became less, so that patient could sleep at night without opiates.

January 15, with local anæsthesia (Schleich's solution) of the skin, with morphine, one-fourth grain hypodermically, the left

half of the gland with the isthmus was removed. It extended more than three centimetres below the first rib, pressing on the trachea. But three vessels required ligation. The isthmus, which was two centimetres in diameter, was ligated and severed, care being taken to avoid the escape of any of the thyroid matter into the wound, and the cut surface was seared with carbolic acid and wiped with alcohol. The wounds in the muscles and fascia were closed with chromicized catgut, and the skin with subcuticular stitch of fine catgut. Duration of operation, one hour. For perhaps half the time the patient complained bitterly, but more of choking sensation produced by the traction on the tumor than of actual pain.

Dr. Ophuls, pathologist to Cooper College, reported that the structure was that of a normal thyroid gland with a great deal of colloid in the acini.

During the first twenty-four hours after the operation the patient vomited frequently, perhaps because morphine was given three times, though morphine had been given before the operation without nausea. The pulse was very rapid and weak, 130 to 140. The patient was delirious part of the night, and urinated involuntarily for three days. A few hours after the operation the temperature rose to 101.5° F., but subsequently did not rise above 100°, and for three days was from 99° to 100°, reaching 98.4° on the fourth day. For four days after the operation the pulse ranged from 120 to 140, but on the fifth day came down to 84. The wound was dressed on the eighth day; complete primary healing. Left hospital on the tenth day.

Patient remained well and gained rapidly in strength and weight,—twenty pounds in two months,—the pulse ranging from 75 to 85; the right lobe of the thyroid then began to enlarge, and after a day of unusual fatigue and excitement the tremor and the tachycardia returned. The pulse rose to 120. Headache, vomiting, and the hepatic pain came on. After a few days in bed these phenomena subsided, to recur again as the goitre enlarged. On re-entering the hospital in May (four months after the thyroidectomy) the pulse ranged from 110 to 120, but after resting in bed for a time went down to from 80 to 100; the temperature, 99° to 100° F. May 29, under chloroform (patient was much less nervous than at the former operation and the heart much stronger), a cyst five by seven by four centimetres was shelled

out from the right half of the thyroid. There was no difficulty in the operation; the chloroform was well borne; few vessels had to be tied. The wound was closed without drainage. Immediately after the operation the pulse was 108 to 120; next day reaching 128, and on the second day 136, after which it gradually went down. On the third or fourth day the patient complained of a feeling of stiffness about the face. There was very definite œdema present of the character of myxœdema. This lasted perhaps a week, and gradually disappeared. The wound was dressed on the sixth day and a little bloody serum evacuated. There was no infection, and the patient left the hospital on the eleventh day. She rapidly improved in general health, and was able to take walks of several miles across country. Her voice became stronger than it ever had been, and she was able to sing in her father's choir, something which she had never been able to do. She felt stronger than for several years.

Recently, two years after the thyroidectomy, she writes that her health has been excellent ever since; that only once, after a severe mental and physical strain, had she had a return of the pain in the right side, but this lasted nearly a week; that she has been teaching school for the last five months, working as she has not been able to work for years. She has gained fifty pounds in weight. Has no nervousness, tremor, or tachycardia.

CASE II.—Mrs. H. O., aged twenty-nine years. Family history negative save distant tuberculosis on the mother's side. She had perfect health till ten years ago, when, at the age of nineteen, she had scarlatina. She has never had other serious illness. She was married a few weeks before the attack of scarlatina, and three months later noticed swelling on the neck on the left side, the size of a walnut. A year later she became pregnant, and noticed that the goitre enlarged rapidly as pregnancy progressed, until at end of term it was the size of a fist. It had slowly increased in size ever since. The labor was protracted, the patient not having strength to expel the child, and forceps had to be used, although the child weighed only six pounds. It died at six months of cerebrospinal meningitis. About this time, *i.e.*, two years after the goitre was first manifest, shortness of breath became distressing. Two years later, or six years, ago, the patient was again pregnant, when the goitre again took on rapid growth. After three months miscarriage occurred. Three or four years

ago her eyes were prominent. At this time the menstruation ceased for two years.

Rapid action of the heart, with periods of palpitation, restlessness, shortness of breath, excessive perspiration, flushing of the face, difficulty in speaking, weakness of voice, general muscular weakness, and diarrhœa characterized the further progress of the disease.

Four years ago the patient noticed feet and legs swelling, at first transitorily, but gradually more and more persistently. The swelling finally reached the abdomen and vulva, so that locomotion became difficult. Patient said that recently even the face and hands have become stiff and rigid from swelling. The swollen parts are numb and cold. The patient has been much troubled with cramps in the legs and arms, and even in the tongue, interfering with speaking. The eyes would at times seem to set so that she could not turn them quickly to look at an object on one side. She complained also of "nervous spells," hot flushes coming on without apparent cause, and with furious perspiration. The patient had no pain beyond an occasional headache, but says the numbness and stiffness in the limbs are very annoying. She is unable to get about and is unable to do her housework, and is so excessively nervous that at times she can scarcely keep from screaming out—"feels as if she were losing her mind."

Status, September 11, 1901.—Large woman, presenting large goitre overhanging sternum in the middle line and extending upward to the left. It was round and smooth, sharply limited, and freely movable. Tremor was marked, fine in character; pulse, 140; respiration, 50; temperature, 99° F. by mouth; weight, 152 pounds. The legs, thighs, vulva, and abdominal walls greatly swollen, livid in color, and of cold, clammy surface. The œdema was not like cardiac or renal œdema, but seemed to be of thicker fluid. It pitted only on very deep and prolonged pressure. The face was thick, the cheeks and eyelids stiff, interfering with articulation and facial expression, the swelling noticeable, and the thickening palpable; the hands swollen and stiff. In an attack of flushing and excessive perspiration, as described above, and due to nervousness from undergoing examination, the respiration became 50 or 60 and pulse 140. Slight cyanosis was evident. Circulation in general sluggish; when blood was pressed out of finger-tips it returned slowly. Finger-nails poorly nourished and thin.

Lid aperture rather larger than normal, but otherwise exophthalmos was not definite. Urine gave specific gravity 1017, alkaline reaction, with slight cloud of albumen, no sugar, no cylindroids, a small amount of bladder epithelium, with an occasional pus-cell.

Besides the fine tremor there were choreic movements, and patient stated that the hands were at times so uncontrollable that she had difficulty in getting her fork to her mouth in eating.

While in bed in the hospital the pulse continued high, 110 to 120, and the respirations 46 to 60. Because of the peculiar character of the œdema, thyroid extract, five grains, was given t. i. d. After three days there was no effect on the œdema, but the nervous symptoms were markedly increased, perspiration was extraordinarily profuse, so that the sheets were saturated frequently. Patient became extremely nervous, thrashing from side to side; pulse, 100 to 130; temperature, 98° to 99.5° F.; respiration, 30 to 60.

September 15. Operation.—While being taken to the operating-room the patient's pulse rose to 160 and respiration to 50 from the excitement. Twenty minims of 1 per cent. solution of cocaine were injected into the skin in two lines over the inner edges of the sternocleidomastoid muscles and across above the sternum. After incision in this line and retraction of the depressors of the hyoid, the capsule of the tumor was laid bare and the smooth mass was shelled out without difficulty. There was but little hæmorrhage, readily controlled. The muscular layers and the fascia were closed with catgut, and the skin with subcuticular suture of fine catgut. During the operation the pulse remained high for perhaps half an hour, but at the end of the operation had come down to 80. Patient did not complain at all of pain during the operation, but afterwards said that she had had some pain, but more discomfort from the choking sensation due to the traction on the tumor. Some hours after the operation the pulse rose to 140, temperature 102° F., and respiration 50, and there was very little variation in these figures for three days, when they began to recede, till on the fourth day the pulse and respiration were 95 and 30, respectively, and from then on gradually diminished in frequency. On the fifth day the wound was examined and found completely healed. On the sixth day

patient was out of bed, on the ninth day walked out into the garden, on the tenth day menstruation began, on the eleventh day she left the hospital in the following condition: face flaccid or in normal condition, sense of stiffness gone, articulation unimpeded, œdema gone from abdominal walls and vulva, thighs less tense than before the operation but still hard, circulation improved, perspiration much less, loss of weight thirty pounds, probably mostly œdema, temperature 97.6° to 98° F., pulse 65 to 80, respiration 20 to 25.

After six weeks she returned for observation; gave the appearance of one in good health; had gained twenty pounds in four weeks; feet no longer swollen, face and hands natural; was able to wear gloves two sizes smaller than before the operation; pulse 86, regular; bowels move once or twice a day instead of fifteen or twenty times, as before the operation; no return of excessive perspiration. One day less than seven weeks after the operation, she took a walk to the top of a hill near her home—a climb of nearly a thousand feet in a mile and a half—keeping up with the rest of the party. She found she could lift her legs in climbing over fences, as she had not been able to do for years. The finger-nails show a markedly better nutrition, the newer portions being sharply distinguished by a well-marked ridge, the old nails being about half gone. No enlargement of the thyroid present. The region of the operation soft, the scar scarcely noticeable.

February 26, five months after operation, patient again returned, with pulse 114 and respiration 28, but she had just walked a considerable distance against a strong wind. After sitting a while the pulse subsided to 80. She said she has had no return of the nervous symptoms. She has been inclined to constipation, and has been obliged to take physic; weighs 151 pounds, a gain of thirty pounds since leaving the hospital. The thighs remain quite hard, otherwise no œdema observable; but the patient says her ankles are a little swollen at night. There is no longer abnormal frequency of urination. Menstruation is regular, but at intervals of three weeks. There is no tremor. Patient says that in walking she can use her legs better than in ten years. She is fond of outdoor exercise and takes long walks. On February 20 she walked twenty miles, lugging a bicycle over a muddy road, up and down

hill. She was not troubled with shortness of breath, and did not suffer unusual fatigue afterwards. She has been doing her own housework for four months, including washing and ironing.

April 12, seven months after operation, the condition as last reported is unchanged, save that the œdema is apparently a little less, and she continued to feel stronger and be less nervous.

The goitre was examined by Dr. Ophuls, who reported as follows: "Tumor the size of an orange, with yellowish-brown cut surface, from which a large quantity of colloid is discharged. In spots, small hæmorrhages. The tumor consists of spherical follicles filled with colloid. The thin partitions between consist of fibrous tissue with blood-vessels. In spots, the lymph spaces in the fibrous tissue are much dilated and filled with colloid. Some of the follicles have ruptured and discharged their contents directly into the interstitial connective tissue. Diagnosis, adenoma thyreoideæ colloides."

To recapitulate: In both cases the symptoms indicative of Graves's disease were secondary to pre-existing goitre; both cases were chronic and were characterized by increased rapidity of heart action, fine tremor, increased rapidity of respiration, excessive nervous sensibility, diarrhœa, periodical increase of these symptoms, with remissions, constant slight rise of temperature, dyspnœa, general muscular weakness, flushings, and sudden periods of excessive perspiration. In the first case, extraordinary attacks of severe pain in the region of the liver; in the other, a curious, general, non-pitting œdema. In neither case were there characteristic changes in the histological appearance of the tumors. In both cases operation was followed by temporary increase of the nervous symptoms, this followed by gradual remission, the one case having recurrence concomitant with development of a cyst in the remaining portion of the gland, relieved by second operation. No further recurrence of nervous symptoms in either case, the one being observed for two years, the other for seven months.

From the stand-point of technique in the operations, neither case is of any particular interest, save that the opera-

tions were done without anæsthetic beyond the local use of a small amount of cocaine in the skin, and that the suffering caused by the manipulation of the deeper parts was bearable, and due more to interference with the respiration and the sensation of choking caused by traction on the tumor than to severe pain.

AVULSION OF THE BRACHIAL PLEXUS, WITH A REPORT OF THREE CASES.

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AVULSION of the brachial plexus without the loss of the arm seems to be a very rare accident. Besides the cases recorded by Bowlby, I have been able to find but one other, that of Milliard in the *International Clinics,* Vol. ii, Series 3. Correspondence with many surgeons of the largest experience in this country emphasizes the rarity of the accident. Dr. Nicolas Senn writes, "I have seen but one case of avulsion of the plexus caused by a tree falling on the shoulder. I considered the case hopeless." So far as I have been able to discover, but two other surgeons have seen cases. One of these cases, operated upon by Hartley, of New York, subsequently came under my care and is included in the cases personally seen by me. The other was that of Dr. P. R. Bolton, of New York, of which an account is published in ANNALS OF SURGERY for May, 1902. Richardson, of Boston, Park, of Buffalo, White and Da Costa, of Philadelphia, McBurney, Bull, Weir, Bryant, Abbe, Gerster, Wyeth, Dawbarn, Lange, Stimson, and Halsted of Johns Hopkins, all write that they have never seen a case, nor have my own colleagues in Brooklyn. In Bowlby's work on injuries of the nerves there are nineteen instances of avulsion of the plexus, but one of these occurring in an infant was certainly not an avulsion, as a certain amount of motion and sensation was subsequently regained without operation. This case should

rather be placed in another class in which belong instances of paralysis from stretching of the plexus. Including the case of Milliard, referred to before, the case of Senn, of Hartley, and Bolton, the writer has been able to collect twenty-four undoubted instances of avulsion of the brachial plexus not accompanied by loss of the limb. Seven of these occurred as the result of forcible reduction of dislocations, four resulted from heavy falls on the shoulder, two were occasioned by blows on the shoulder received in railroad accidents, and five were caused by falling objects striking the shoulder. Three were caused by traction of the extended arm. The cause of the remaining cases is unknown. Very few of these injuries received operative treatment. In the cases reported by Bowlby, but two were submitted to operation. Banks's patient was a sailor, who fell on his shoulder down the hatchway about a couple of months before coming under notice. The pulse was absent in the radial, ulnar, brachial, and axillary arteries. The deltoid muscle alone reacted to faradism and the great pectoral very slightly. An exploratory operation revealed that the plexus had been torn away bodily from the spinal column and had been dragged below the clavicle, with the exception of one small cord which appeared to supply the deltoid and pectoralis major. No mention is made of any attempt at suture. The axillary artery had been injured and was found obliterated. The other case upon which operation was done was that of a man who had been hit on the shoulder by a buffer of an engine, which fractured the clavicle and the upper extremity of the humerus. The patient said that all feeling and motion had gone from the arm when he recovered consciousness. Six months later, under the impression that the axillary nerves might have been torn, they were freely exposed in the axilla, but were found intact. This seems to have been an entirely futile procedure, for, unless the subclavian triangle was opened and the origin of the plexus sought in the neck, it would have been utterly impossible to state that the trunks had not been avulsed from the several nerves composing them, and, as the operation was done so long after the accident, trac-

tion of the nerves in the axilla would prove nothing, for the torn ends would have very speedily contracted adhesions. This was shown by one autopsy. Therefore, no conclusion could reasonably be drawn from the fact that the cords resisted traction where exposed in the axilla. I have therefore retained this case as one of avulsion of the plexus. Senn states that he regarded his case as hopeless. Hartley submitted his case to operation. Of the three cases that came under the care of the writer, one of them was seen three years after the accident and was considered hopeless. The second case was that of Hartley seen one year after operation. The third case coming under observation just after the accident was operated upon by the writer on the third day. The history of the three cases is as follows:

CASE I.—Three years after the accident, there came into the Long Island College Hospital a man with complete paralysis of both motion and sensation in the right upper extremity. He stated that, while at a fire in a country town in Connecticut, a falling ladder struck him on the shoulder and felled him to the ground. On regaining consciousness he found that sensation and motion had both disappeared from his arm. There was also a fracture of the clavicle in its middle third. On examination, there appeared to be but a moderate amount of displacement of the fragments, with good union and no excessive callus. Sensation was entirely gone except over the area of the intercostohumeral nerves. All the muscles were much wasted. Their reactions were not tested, nor were the pupils compared. No operation was proposed, as the length of time which had elapsed since the receipt of the injury seemed to render inevitable the degeneration of the nerve tracts in the spinal cord, and the man passed from observation.

CASE II.—Dr. Hartley's case seen by me one year after operation. In December of 1901 a physician of this city brought to my clinic at the Long Island College Hospital a Swede with a total paralysis of motion in the right upper extremity and a paralysis of sensation, also complete except the area supplied by the intercostohumeral nerves. There was an operation scar over the site of the brachial plexus, and, as the patient said that he had been operated upon by Dr. Hartley, of the New York Hospital, I com-

municated with him, and he kindly furnished me with the following particulars. The patient had fallen through a hatchway for three stories, and part way down his arm had caught in a rope, which, however, held him but a moment as he fell. On admission to the hospital, it was supposed that he had received a fracture of the skull as well as the injury to the arm. When he had recovered sufficiently to admit of operation, Dr. Hartley cut down on the plexus for the purpose of suturing it. The clavicle was resected for the better exposure of the plexus, which was found much torn and with frayed-out ends, buried in much cicatricial tissue. The operator was unable to bring the ends in apposition, and was obliged to use catgut sutures *à distance*. He wrote me that the operation was most unsatisfactory. I regret that I made no precise record of the paralyzed areas at the time I first saw this patient. My recollection, however, is that there was a total motor and sensory paralysis of the entire arm, with the exception of the intercostohumeral area. At present his condition seems not entirely hopeless. He has regained the use of the internal and external rotators of the arm, and has recovered sensation over the upper arm in all areas save that supplied by the internal cutaneous nerve. There is also a triangular area on the posterior surface of the forearm just below the olecranon which has some modified sensation. He complains of feeling some pain in the fingers, but, with the exception of the small area mentioned, there is a total paralysis of the forearm with much wasting of muscles. Those of the upper arm do not seem to be wasted in proportion. He has the contracted pupil and diminished palpebral fissure which indicate sympathetic involvement, but says he is not conscious of sweating less on the affected side than on the other. There is no œdema of the arm and there is a normal sense of warmth to the touch.

Case III.—The patient, a colored man, sailor by occupation, was brought into the Long Island College Hospital one Sunday with a complete paralysis involving the left upper extremity, with the exception of the sensory area of the intercostohumeral and the circumflex nerves. There was also a fracture of the ulna. The injury had been received in the following manner. While at work about a steam-winch on the vessel, the patient had attempted to throw the rope into place while the steam was on, and his forearm, becoming entangled in the rope, was dragged under the winch. There was not much pain at the time. After

his arrival at the hospital he felt severe pain, which was referred to the arm, which he said had the sensation always of extreme extension. A careful examination showed that it was probable that the plexus had been avulsed; and from the fact that there was considerable swelling in the inner region of the subclavian triangle, and that the left pupil was contracted, it seemed most probable that the nerves had given way close to the intervertebral foramina. From the fact that the convexity of the shoulder down to the insertion of the deltoid preserved sensation, it also seemed likely that some fibres, at any rate of the posterior cord, still maintained their integrity. This, however, proved to be erroneous. The effusion at the base of the neck negatived the supposition that the nerves had been simply stretched, an injury which has actually happened several times, as evidenced by the subsequent return of motion and sensation at varying periods without operation.

The writer determined first to cut down on the subclavian triangle for the purpose of exploration, further procedure to be governed by the conditions disclosed. The exploratory incision was begun posterior to the sternomastoid, on a level with the lower border of the thyroid cartilage, and was carried down to the clavicle and thence along the bone to the acromioclavicular joint. A triangular flap turned back gave ample exposure of the origin of the plexus. On opening the deep fascia some recent blood-clot was exposed. Neither the cords nor trunks of the plexus, however, could be found. Short stumps just protruding from the cellular tissue between the anterior and middle scalenes were all that could be seen of the nervous structures. They were much frayed and ragged, and perhaps half an inch long. It was evident that the plexus had given way just at the point where the four cervical nerves and the last dorsal unite to make up the three trunks, the nerves giving way from above downward as the strain came upon them successively. The lost trunks could not be seen in the wound. A third incision was therefore made, commencing just a little to the inner side of the acromial process, and this was carried downward and inward, so that it lay parallel to the incision in the neck. The clavicle was now sawn asunder and the two pectorals divided. The ends of the clavicle being retracted, a full view of the whole tract occupied by the plexus was plainly in sight. The nerves were traced from below upward, and the torn ends of the trunks found well underneath the clavicle. There

was no difficulty in bringing the torn and ragged ends of the three trunks up to the stumps of the nerves in the neck, as in Hartley's case. Indeed, it was evident that before the nerves had given way they had stretched greatly, so that it was possible to cut off the ragged portions of the trunks; but when it came to restoring the original anatomical relations, that was quite another matter, for it was not possible to determine which part of each trunk belonged to the several nerves of origin. It was possible, however, to identify the trunks, and these were sutured with catgut in their natural order. The ends of the sawn clavicle were then united with chromicized catgut and the large wound closed, the arm being secured to the chest in a Sayre dressing of adhesive plaster. No febrile reaction followed, and the stitches were removed at the end of a week. One month after operation the condition of the patient was as follows. With regard to the electrical reactions which were kindly tested for me at the Polhemus Clinic by Dr. Onuf, it was found that the reaction to the faradic current was entirely lost in all the muscles supplied by the brachial plexus, those of the scapula suffering as much as the intrinsic muscles of the arm and forearm. The trapezius reacted very feebly. The sternomastoid somewhat more strongly, but still deficient. The reaction of degeneration was present in the anterior fibres of the deltoid in the biceps and triceps, but was sluggish and greatly diminished. There was no response whatever in the extensor and flexor groups of the wrist and fingers. Sensation has never been absent over the sensory area usually supplied by the circumflex nerve. The area of the nerve of Wrisberg and of the internal cutaneous branch of the musculospiral has regained sensation, which was lost at the time of operation. The skin of the arm and forearm was in a condition resembling senile atrophy, and was much darker than the other side. On the sound side it was noted particularly that the electrical reactions were weaker than normal, and there was a slightly increased tendon reflex at the knee, that on the injured side, however, being normal.

The following symptoms denoting injury to the sympathetic were present. The left pupil was contracted more than the right. The palpebral fissure was much diminished. The eyeball appeared to be smaller than its fellow, less prominent, and of less tension. The vision was less perfect. The left ear was somewhat colder

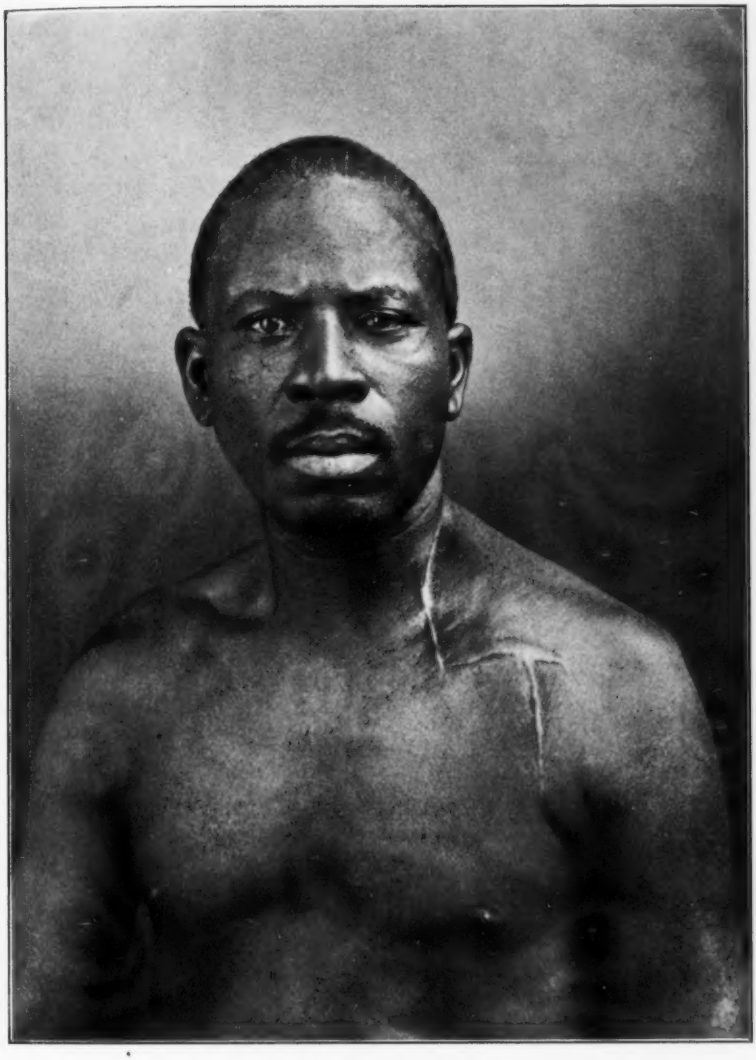

FIG. 1.—Showing diminished palpebral fissure on injured side, with slight hemiatrophy of face.

than the right, and there was a condition of the skin on the affected side, particularly of the arm and forearm, which resembled senile atrophy. There was some hemiatrophy of the face; but there did not appear to be any special dryness either of the conjunctiva, nostril, or mouth on the injured side. Four days later, some œdema had made its appearance in the arm and forearm, and there was a distinct gain in the sensation in the areas before mentioned.

There are a number of interesting problems which present themselves in the review of this symptom complex. First, as to the preservation of sensation over the area usually supplied by the circumflex. This may be due to one of two facts. Either the filaments of the supra-acromial branch of the cervical plexus came lower down than usual in this man, or the preservation of sensation is due to collaterals *already* existing or developing between the supra-acromial and circumflex nerves, through which paths sensory impulses now travel from the area of the circumflex nerve. In support of such a possibility. Bowlby states that if the parts supplied by a divided nerve be tested with care, it will very frequently be found that they are not completely anæsthetic. This sensation he calls supplementary sensation, and proceeds to give a number of instances. To quote two will suffice. "A young woman sustained a cut across the wrist which divided the median nerve. Richet wished to demonstrate the result of section of a nerve. To his astonishment, sensation was preserved when he touched the thumb, middle, and ring fingers."

Baudens records a more astonishing case. "A Zouave received a sabre-cut in the axilla which divided many muscles, —the axillary artery and the median, ulnar, internal cutaneous, and musculocutaneous nerves. The limb remained warm, and after twenty-four hours the least pressure on the hands and fingers was painful. During the following days sensation became blunted, but so long as the patient lived, no cutaneous anæsthesia could be established in any part of the upper extremity. While it is true that there are areas of overlapping, in nerve-supply this fact hardly explains such cases. I have a case of my own at present where there is diminished sensation

over the sensory area of the musculospiral nerve, but, with the exception of slight power of extension of the fingers, a complete motor paralysis of the extensors and supinators as a result of injury. In the case under discussion, sensation has returned to the area of the nerve of Wrisberg and the territory of the internal cutaneous branch of the musculospiral. Is this due to a reunion of the conducting fibres in the neck or the establishment of a collateral sensibility? It is quite certain that the territories in question were completely anæsthetic at the time of operation. Sensation, moreover, since it first reappeared, has improved. Is this due to the establishment of collateral paths by way of the intercostohumeral nerves which supply the territory next adjacent, or to reunion of the torn nerves? So sharply is the area of the nerve of Wrisberg outlined by returning sensation, that it would make an excellent example to demonstrate the distribution of the nerve before a class, and it seems like assuming a great deal to say that the returning sensation is due to collateral paths. Nevertheless, it ought to be remembered that the nerve of Wrisberg receives filaments from both the second and third intercostals, and that it is not impossible that sensory impulses now take this path. The return of sensation to the internal cutaneous branch of the musculospiral without any evidence of repair in the motor paths or in the radial distribution is more difficult. It is not strange that in the phenomena of repair, sensation should return before motion, for the phenomena of sensation are dependent on the regeneration of the nerve alone, while the restoration of motion must depend somewhat on the regeneration of the wasted muscle. If reunion has taken place so that the sensory paths of the internal cutaneous branch are travelling by their accustomed route, why does not the radial transmit sensory impulses? Do sensory waves travel through the adjacent nerve of Wrisberg and the intercostohumeral nerve by collateral connections of the adjacent systems? This seems a possibility, at least when we remember the terrific stretching that the plexus received before giving way, and bear in mind, also, the long period of time that

elapses before restoration of function after stretching of nerve-trunks in other parts of the body.

Certain peculiarities in the architecture of the brachial plexus have some bearing on this point. If the three trunks are torn from their constituent nerve-roots, there are still two communications between the spinal cord and the axillary part of the torn plexus, namely, above by the small cord of communication between the fourth and fifth cervical nerves and below by the loops of communication between the nerve of Wrisberg and the intercostohumerals with the first, second, and third intercostal nerves. The upper branch of communication is almost certain to be torn by the plexus as it disappears beneath the clavicle. The lower branch, however, is never torn, as from its position it cannot be injured, as evidenced from the fact that all the recorded cases have retained sensation in the area supplied by the intercostohumeral nerves. Now, in both Hartley's case and my own sensation has returned in those parts of the cutaneous distribution of the musculospiral nerve which are adjacent to the territory of the nerve of Wrisberg and in the area of Wrisberg itself, that being directly adjacent to the intercostohumeral area. The area of the internal cutaneous, however, which lies between the intercostohumeral area and the internal cutaneous branch of the musculospiral is still anæsthetic. There are no loops of communication, be it observed, between the nerve of Wrisberg and the internal cutaneous, although both are branches of the inner cord, whereas the loops between the intercostohumeral and the nerve of Wrisberg have already been pointed out. A somewhat unexpected discovery was that of the partial paralysis of the sternomastoid and the more complete paralysis of the trapezius, though the latter muscle still retained some power. When we remember the origin of the spinal accessory, together with the fact that all of these cases bear evidence of injury to the sympathetic, the two symptoms seem at first to belong together. The spinal portion of the accessory arises by filaments which extend from the first to the sixth cervical nerve and pass up between the ligamentum

denticulatum and the posterior root of the spinal nerves. The sympathetic nerve receives branches of communication from the anterior roots of the cervical spinal nerves. When the plexus was put upon the stretch and before it gave way, the rami communicantes of the sympathetic corresponding to the five spinal nerves which make up the plexus must have been torn or greatly stretched. At the same time the traction exerted on the cord may have damaged the filaments which make up the spinal portion of the eleventh cranial nerve, or possibly that portion of the lateral column from which the filaments emerge may have been bruised. It seems impossible, however, that the first supposition can have been correct, from the protected situation of the filaments of origin within the spinal canal; and if the lateral column was sufficiently bruised to interfere with the transmission of impulses through fibres arising at the point of bruising, we should expect symptoms of lateral column mischief at other points. There are none, however. The most reasonable hypothesis is that the traction on the shoulder also stretched the nerve as it enters the trapezius muscle, so that it received its greatest injury just before entering the muscle. If this were so, then the trapezius ought to be more paralyzed than the sternomastoid, which is the case. On the other hand, if the injury had taken place in the filaments of origin, both muscles would have suffered equally, which is not the case.

The symptoms of injury to the sympathetic deserve some consideration. The contraction of the pupil of the affected side is evidently due to the fact that the sympathetic nerve has lost the ciliospinal fibres which join it from the first and second dorsal nerves. The pupillary phenomenon was first demonstrated by Pourfour du Petit in 1727. G. Fischer excised the cervical sympathetic in two decapitated men and produced opening of the palpebral fissure, dilatation of the pupil, protrusion of the cornea, and lachrymation. Exactly the reverse of these symptoms is present in the case under consideration. The narrowing of the palpebral fissure is due to a paralysis of those bands of unstriped muscle in the upper lid known

as Müller's muscle. The sinking in of the eyeball may be due to the shrinking of the cushion of fat in the orbit, and this in turn to nutritive changes due to a paralysis of the vasodilators in the blood-vessels. Ogle, quoted by Bowlby, ascribes this symptom to the paralysis of a funnel-shaped layer of involuntary muscle which has been shown by Prevost to have the power of causing protrusion of the eyeball. (Morris, the orbital muscle of Müller.) There is probably a change in the actual diameter of the eye as well, as there is certainly a change in the intraocular tension. Both Claude Bernard and Brown-Sequard found that section of the sympathetic causes flattening of the cornea. The hemiatrophy of the face, the coldness of the ear, the anidrosis of the face, neck, and arm of the affected side seem to support the theory of the influence of the sympathetic over the function of the sudoriferous glands. A hemiatrophy which does not depend on the wasting of paralyzed muscle must depend on other nutritive changes producing shrinkage of tissues, and this could be brought about by a paralysis of the vasodilators which would leave the constrictors unopposed. A similar explanation may be invoked to account for the anidrosis, for the production of sweat is, if not entirely, nevertheless in part, dependent on an increased blood supply to the glands. Adamkiewicz, Vulpian, and others have striven to show that the secretion of sweat is due to an independent set of fibres, but the matter is still in doubt. Landois and Stirling say that the secretory nerves and those for the blood-vessels seem to lie in the same trunks. Nevertheless, although it is known that all the nerves constituting the brachial plexus were disrupted in this case, still, sweating does occur, although to a diminished degree, on the injured side. The curious wrinkling of the skin that was observed to be present for a time has been noted in other instances of this injury, and may be due to a paralysis of the unstriped muscle fibres of the skin. (Payne quoted by Bowlby.) The œdema of the arm which has been occasionally observed did not at first exist in my case until some days after the Sayre dressing had been removed, and the forearm and elbow allowed to rest

in an ordinary sling. The œdema was, when it appeared, greatest in the forearm, and ceased rather abruptly at the level of the insertion of the deltoid muscle. After a week or two it disappeared. Whether this symptom was due to the injury of the sympathetic or not is doubtful. Angioneurotic œdema, say Onuf and Collins ("Experimental Researches on the Sympathetic") furnishes the most exquisite type of a serous exudate secondary to vasomotor influence. It is possible that the œdema was of this type. Nevertheless, if the exudate was due to a relaxation of vascular tension, we are left in the dilemma of calling on a dilator paralysis to account for one set of symptoms and a constrictor paralysis to account for another set. It seems, if both are present, that the vessels ought to be in a condition of equilibrium so far as their caliber is concerned, but to have lost all power of adjusting themselves to circumstances. Mention has been made of the fact that the muscular reactions on the uninjured side were slightly subnormal, and that the knee-jerk was slightly increased, while normal on the injured side. This impairment of muscular reaction on the uninjured side may have been due to traction on the cord itself at the time of the accident, and a consequent stretching of the plexus of the other side. This is not a purely theoretical conjecture, as the experiments of Bowlby and others show. In this connection, Bowlby says, "If the brachial plexus be exposed in the neck, the cord can certainly be drawn upon if sufficient force be applied." Finally, what is the prognosis of injuries of this description, and what ought to be their treatment? In discussing the first question, it is to be noted that the separation of nerve-trunks by avulsion offers an essentially different problem to the simple division of nerves by cutting instruments. In the latter cases, the nerve-trunk has received no injury save the division of its fibres at the point of incision, and repair may be expected when the ends are sutured promptly. Even after months of delay, if the nerve ends are found and sutured there are many cases on record which show that the return of function may confidently be expected. It is quite different, however, with an avulsed

nerve. Here the nervous structures for some distance have been severely stretched; so that to the accident of separation we must add the effects of the severest possible stretching. Briefly, these consist in segmentation of the myelin, breaking of the sheath of Schwann, loosening of the sheath from its attachments to the nerve, with constriction of the tubules, all these phenomena occurring not simply at the point of rupture, but extending for some distance therefrom. (Marcus and Wiet, cited by Bowlby.) In considering the progress of repair, it is then evident that the injury to the nerves is far more wide-spread in cases of avulsion than in the more common cases of simple division. We must expect, therefore, that the period of repair will be longer and the return of function much later. Dr. Hartley's case shows the wisdom of early operation. There, owing to circumstances, it was not possible to interfere at once, and when the operation was undertaken, the peripheral ends were buried in a mass of cicatricial tissue, and so contracted that it was impossible to bring them up to the central ends, therefore the *suture à distance* was resorted to, which does not offer so good a prospect as absolute approximation. To illustrate the disadvantages of this method, attention is called to Fig. 2, which is a section excised from the median nerve under the following circumstances. A United States soldier, while on the march to Pekin, received a Mauser bullet wound of the forearm, which healed without incident, but left a paralysis of the parts supplied by the median nerve. A few months afterwards, as he was suffering from much pain at the seat of the injury, the nerve was exposed, and a neuroma was excised together with about three inches of the nerve. It was not possible, after the excision, to bring the ends of the nerve together, and catgut *sutures à distance* were used as in Hartley's case. One year after this he came under the care of the writer, complaining of atrocious pain at the site of the first injury, but without any return of either sensation or motion below this point. The nerve was again exposed, and a fusiform mass about an inch and a half in length was excised. On flexing the wrist, apposition of the

ends was easily attained, and the pain of which the patient had complained was relieved. Sections were made of the excised portion of the nerve, and the figure shows what had taken place along the *suture à distance*. It is evident that most of the new tissue is fibrous, and that there is no continuity whatever of the axis cylinders. The pain may be accounted for by the imprisonment of nervous tissue in what

FIG. 2.—Section of pseudoneuroma of median nerve after suture *à distance*. A, nerve-fibril; B, fibrous tissue.

is nothing more than a cicatrix, and while on inspection at the time of operation the nerve seemed continuous, it was really not so, the bridge consisting merely of fibrous tissue. If good results are to be anticipated, it seems important then to interfere as soon as possible after the injury. The longer the interval which elapses, the less the prospect of the restoration of function. There seems to be an advantage in the division of the pectoralis minor and the upper part of the major, as by this manœuvre the three cords may be easily iden-

tified in the upper axilla, and from thence easily traced upward. Without operation, of course no return of function can be expected.

[NOTE.—Since writing the above, in the writer's case sensation has returned to the area of the internal cutaneous nerve, so that the patient now has complete sensation over the entire upper arm. He states that, with the arm bent at a right angle and carried in a sling, he feels as if the arm was "sticking straight out from the elbow," which is, of course, the last sensation that the cortex recorded before it was cut off from communication with the arm.]

NOTE ON PERMANENT SUPRAPUBIC DRAINAGE FOR ADVANCED TUBERCULOSIS OF THE BLADDER.

REPORT OF A CASE AT END OF FIVE YEARS.

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Mr. B., a man aged fifty years, was referred to me by Dr. S. A. Fisk, of Denver, February 1, 1895. His wife and two daughters died of pulmonary tuberculosis. He had had for years a moderate cough from time to time, but had never spit blood and had given no definite evidence of pulmonary disease. During the past year he had had an increasing irritability of the bladder. Urination had gradually become more frequent. There was very marked spasm of the bladder when he moved about. Vesical discomfort and tenesmus were now urgent. During the last few months he had twice been examined by surgeons, with negative result. He had spent a considerable portion of the last year in hospitals; had rested throughout the preceding summer, but without improvement.

Examination.—The patient is a man of rather spare physique, who appears to be between sixty and sixty-five years of age. Examination of the chest is negative. He urinates every half-hour both day and night. He takes three-quarters of a grain of morphine daily. His bladder capacity at this time is about one ounce; there is about one-half ounce of residual urine. The urine is pale, neutral, its specific gravity 1014. It contains bacteria, bladder epithelium, mucus, and a little pus. Tubercle bacilli are sought, but not found. Cocaine examination for stone is negative, the introduction of the searcher causes slight bleeding. Cystoscopic examination is recommended, but refused. So far

[1] Read before the American Surgical Association, June, 1902.

as one can judge, there is no other tubercular lesion of the genito-urinary tract. The patient was at that time treated by me locally for two weeks, with practically no improvement.

I next saw him in December, 1896. During the interval he had travelled here and there throughout the country, and had consulted many physicians, but had grown worse rather than better. He at that time urinated every ten or fifteen minutes day and night. He had marked spasm at the neck of the bladder, and his life was in all ways miserable. He was taking about four grains of morphine daily. There was marked hæmaturia most of the time. He was examined under chloroform December 26, 1896. Bladder capacity about six drachms. Cystoscopic examination revealed an irregular ulcer three-quarters of an inch in diameter at the neck of the bladder posteriorly. This ulcer bled very easily. No stone was found. After prolonged search, Dr. H. C. Crouch, State Bacteriologist, reported that he found scattered tubercle bacilli in the urine. Permanent suprapubic drainage recommended.

Operation.—At St. Joseph's Hospital, February 8, 1897. Chloroform. Trendelenburg position. Bladder distended with about one ounce of filtered air. Suprapubic incision. Peritoneum not recognized. Gaseous bladder felt. Incision just above and behind pubes opened bladder. Bladder drawn up. It was apparently not larger than an English walnut. The entire wall was thickened, intensely congested, and studded here and there with miliary tubercles. There was an irregular ulcer the size of a penny at the neck posteriorly, rather more on the left side. This ulcer was gently curetted and its base cauterized with pure carbolic acid. It bled pretty freely. The bladder was drawn up and its edges stitched to the skin. It seemed to resemble in size and shape the finger of a glove. The orifices of the ureters were not seen. A large drainage tube was placed in the bladder, care being taken that its end should not touch the posterior wall, and the bladder was tightly sewn about it. The outer wound was partially closed.

The patient reacted fairly well, secreting urine freely. During the first few days morphine was given liberally. The bladder and wound were scrupulously cared for by a competent nurse, and the patient was kept dry. The bladder was frequently washed out with a very weak bichloride solution, followed by a boric-acid solution. The abdominal wound above and below the sinus healed

throughout by primary union. The patient was out of bed on the tenth day, and at the end of three weeks was wearing a permanent tube and urinary receptacle. At that time his morphine had been decreased to two grains daily. A month later he resumed his occupation, that of travelling auditor for a large national corporation. During the two or three months immediately following the operation there was occasionally moderate leakage about the tube. The tube itself was a soft-rubber catheter, size 30 of the French scale, having a velvet eye at the end as well as at the side. It was carefully adjusted and well held in place. Twice daily the patient removed and boiled the entire apparatus and washed out his bladder. His relief from suffering was marked and he was quite comfortable. His spirits returned, he gained in flesh and strength, and was able to decrease his morphine to something less than a grain daily. Three months after the operation I judged the tubercular ulcer to be healed.

The patient continued from year to year in a comfortable and generally satisfactory condition. At no time did I think it wise to recommend removal of the tube and closure of the fistula. I saw and examined him yearly, as once a year his business brought him to Denver for two or three weeks. I last saw him in the summer of 1901, four and one-half years after operation. At that time he was in better weight and general health than in many years; he was comfortable, except for the nuisance of the urinary fistula. The tube fitted snugly. The sinus would leak a trifle occasionally; but hardly enough to be a disagreeable factor. The patient expressed himself as eminently satisfied with the result. I did not examine the interior of the bladder.

This man's home is two thousand miles from mine. In order to know something of his present condition, I wrote to him under date of February 14, 1902, and received the following reply:

"During the first nine months of the past year I was better and had less trouble and worry than at any time since the operation. I weighed more than at any time in my life and attended to business constantly. During the past three months, however, the condition has changed. About November 1 of last year I put in a new tube. I think that this was rough and irritable. It made the sinus sore and led to leakage. Of late the soreness has disappeared, but more or less leakage continues. I have lost in weight and am less comfortable than formerly; but, as I say, I attribute the discomfort to an ill-fitting tube."

To sum up this case: a man fifty-two years of age had suffered for some time from vesical tuberculosis. The bladder was very small; urination was almost constant. Local treatment made him worse rather than better. A permanent suprapubic fistula gave him comfort and relief, and under this the tubercular ulcer healed. Up to four and three-quarters years after operation he made progressive gain in health, strength, and weight. At this time the introduction of a badly fitting tube led to discomfort and leakage, and, it may be, to tubercular relapse. I judge it probable that he will regain the lost ground after the bladder is again drained in a suitable way.

As one searches the literature of this subject he cannot but be struck by the paucity of carefully recorded cases. Most writers on vesical tuberculosis say that suprapubic drainage should be made in suitable instances, but very few cite cases in which this has been done or detail complete histories. Thus, in a discussion on "The Value of Surgical Intervention in Tuberculosis of the Bladder," before the International Medical Congress of 1900, Saxtorph (*Centralblatt für Chirurgie*, 1901, S. 81), of Copenhagen, spoke at length on occurrence, pathology, symptoms, etc., but contented himself with the statement that his operative results have been mediocre. Loumeau, of Bordeaux, reported in general on twelve operations. One of these was done for palliative effect alone; of the other eleven cases three were cited as relative cures (no details given); eight were said to still preserve a suprapubic opening. Various periods up to three years had elapsed.

Strauss (*Wiener medicinische Wochenschrift*, 1897, No. 51) in one instance opened the bladder above the pubes, cut out and scraped out a tubercular ulcer, and sewed the bladder up. After a secondary operation for fistula he gained healing, which lasted five years. J. J. McGrath (*New York Medical Journal*, January 21, 1899) reports a result, said to be a cure, ten months after operation. The bladder was studded with miliary tubercles; there were several small ulcers present. The bladder was drained for about six weeks and washed out daily.

It is probable that a true primary tuberculosis of the blad-

der is very rare. The lesion is generally secondary to tuberculosis of some other part of the genito-urinary tract, extending from the kidney above or from the testis, prostate, or seminal vesicle below; or it may be secondary to lung tuberculosis; or, as I believe to be the case in the patient who is the subject of this communication, to tuberculosis of the bronchial glands.

Mansell Moulin (*British Medical Journal*, May 14, 1898) thinks that when a tubercular ulcer of the bladder is found at or near the orifice of a ureter it is sufficient evidence of tubercular kidney. Battle has operated (no details) on six cases, in none of which has he been able to find evidence of tubercular disease elsewhere, but he admits that it is often difficult to say whether the disease is primary or secondary.

The management of vesical tuberculosis in its early stages should rest upon the establishment of the best possible hygienic conditions. Nutrition should be improved to the greatest possible degree. Bodily rest will aid. In general, one may say that climatic and other conditions best adapted to the successful management of pulmonary tuberculosis are also best calculated to bring about the arrest of a tubercular process here. After a residence of eight years in a dry climate of high altitude, I feel convinced that the average case of so-called surgical tuberculosis pursues a more favorable course here than at the sea level.

Instrumentation of the bladder should be avoided when possible. The bladder should never be distended. When urination begins to reach the incessant stage and cystalgia is marked, the rest afforded the urinary reservoir by a suprapubic opening will give the patient comfort, permit improvement of general nutrition, and conduce in so far as may be possible to an arrest of the local tubercular process. However great the discomfort of a urinary fistula, it is but little when compared with the torture of a tubercular bladder in an advanced stage.

ANATOMICAL AND TECHNICAL REASONS WHY THE PERINEAL IS PREFERABLE TO THE SUPRAPUBIC ROUTE IN PROSTATIC SURGERY.[1]

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Up to the present time the patients suffering from enlarged prostates have not received the relief to which they are entitled. We begin to realize that the catheter is but a makeshift. It doubtless served a good purpose in preantiseptic days, but with our present methods it is an open question whether, by preventing early operation, it does not do more harm than good. Many good surgeons believe, to-day, that a prostatic's real danger begins with the use of the catheter.

It is very fitting that we should at this time exchange views and experiences upon this subject, for we should be able to say to these sufferers, when they arrive at a point where they can no longer empty their bladders without artificial aid, that we have an operation that will quickly and safely relieve them. We owe it to ourselves to so perfect our technique that we can conscientiously recommend the operation to them before their bladders and kidneys have become dangerously infected. It is not in keeping with modern surgery to accept as the only indication for radical treatment a threatened break-down in catheter life. The more perfect our technique for the radical operation, the less use we will have for the palliative operations, because it is only after radical operation that the cure is complete and permament. We must popularize the operation so that we can gain permission to perform it early.

[1] Read before the American Surgical Association, June, 1902.

The present lively interest manifested in the subject is in marked contrast to what it has been in former years. In the nineteen years' history of this Association very few papers have been read upon this topic.

In 1885, Gouley read a paper describing a set of new instruments for the performance of Mercier's operation. He reported nine cases in which he performed this operation, with one death and three recurrences. He advised the use of the catheter in all cases after the operation. He mentioned Bottini's operation, but questioned its utility. In the discussion of this paper, S. W. Gross recommended perineal prostatotomy.

In 1888, Hunter McGuire read his classic paper on "Formation of an Artificial Urethra for Prostatic Obstruction."

In 1893, J. W. White read a paper entitled "Present Position of the Surgery of the Prostate," which excited world-wide attention. He spoke favorably of suprapubic prostatectomy and of prostatotomy, but condemned perineal prostatectomy because he claimed that in only one-third or one-fourth of the cases could the prostate be reached by that route. The chief point in this paper, however, was the suggestion of castration as a method of treatment for enlarged prostates.

In 1895, White and Mears reported cases treated by castration.

In 1898, Lane contributed a very brief paper advocating suprapubic prostatectomy.

This is certainly a very small showing for so important a subject in so long a time, and is in marked contrast to the literature upon analogous conditions in women during the same period. This lethargy was probably largely due to our mistaken belief as to the influence of age *per se* upon surgical operations. Age is no contraindication to prostatic surgery so long as the kidneys are not too far gone.

Although the writer has done most of his prostatic work by the suprapubic route, he is convinced that the perineal operation is the operation of the future. In arriving at this conclusion, careful dissections have been made and specimens preserved.

It seems rational to conclude that the surgeon who hopes to achieve the greatest success should be able to perform each of the different prostatectomies with equal skill, and to be able to choose the one best fitted to each individual case, but the tendency is to popularize one method, and to so perfect it that it becomes applicable to the vast majority of cases. It is of interest, in this connection, to recall the history of lithotomy. Although the suprapubic operation for stone was introduced in the sixteenth century, it was looked upon with disfavor until within a very few years. In Agnew's "Surgery," published in 1889, the author states that the suprapubic operation is four times as dangerous as the lateral perineal, and advises that the upper operation be employed only when the stone is very large, but at the present time the upper operation is universally accepted as the safest and best cutting operation for stone.

The writer became a believer in the feasibility of the perineal route for prostatectomy through his experience with massage of the prostate through the rectum. In many instances the prostate could scarcely be reached through the rectum, but it was found that by introducing a short-curved sound and turning it over, pointing the tip towards the rectum, the prostate could always be dragged down so that every part of the gland, and even the base of the bladder beyond it, could be easily reached.

From an anatomical standpoint every fact is in favor of the perineal and against the suprapubic route. The cystitis in these cases is always secondary to the prostatic changes, and no matter how severe it may be, it improves rapidly after removal of this mechanical cause followed by drainage. We have all demonstrated repeatedly the fallacy of the belief that the bladder has undergone irreparable degenerative changes in chronic cystitis from enlarged prostate. The bladder is not the offending organ, and not the one to be operated upon in these cases; but in order to reach the enlarged prostate by the suprapubic route, whether the enlargement be in the lateral or central lobes, two and sometimes three openings must be made into it. Each of these openings made into a viscus with septic contents must

have an independent mortality rate, and should be avoided if possible.

The prostate is not developed until puberty, and its function evidently has to do with generation and not with urination. It has been clearly demonstrated that its removal does not interfere with urination or bladder control. It must be, therefore, when a patient loses control of his bladder, as sometimes happens after a prostatic operation, that it is due to injury to the bladder itself. By the suprapubic route serious injuries to the bladder are essential features of the operation, and the amount of injury cannot always be controlled, but by the perineal route the bladder need not and should not be injured. Although some of the muscular fibres of the bladder are continuous with the prostate, a good thick bladder wall is left after the prostate is removed. Even when the third lobe projects well into the bladder, it pushes the bladder wall ahead of it. The prostate lies entirely outside and below the bladder, being much nearer the perineal than the abdominal surface. The writer has made careful measurements on the cadaver, and has found that from the surface of the skin to the prostate is twice as far by the upper as by the lower route. The approach by the perineal route is through comparatively unimportant anatomical structures. The transverse and horseshoe incisions in the perineum as originally made for prostatectomy are open to the same objections as the upper operations. They are too much surgery and offer a large field for infection. They sever arteries and nerves and cut muscles crosswise. The median perineal incision, however, has none of these objections. It permits access to the prostate by the most direct route; it severs no blood-vessels or nerves, and it separates muscular tissue along a natural line of cleavage.

After removal of the prostate by either route, the generative function is probably abolished because the ejaculatory ducts are destroyed. The act of copulation can be performed, but it is scarcely possible that the contents of the vesicula seminales can reach the urethra, and if it should, the chances are that, lacking the secretion and the ejaculating force of the prostate,

it would get no farther or would lose its efficacy in transit. Fortunately, our patients are at the age when they have very little concern for this function, and are perfectly content if they can present a good appearance.

Some writers claim to have performed total prostatectomy by the suprapubic route with preservation of the prostatic urethra (Freyer, *British Medical Journal*, February 1, 1902). The organ can be completely extirpated by either route, but the preservation of the whole urethra is an anatomical impossibility, because of its close attachments at the point of entrance of the ejaculatory and prostatic ducts.

When a total prostatectomy is performed, the prostatic urethra must always be seriously injured and often destroyed. The perineal route offers much better opportunity for careful dissection and preservation of the parts. While the prostatic urethra has often been sacrificed in total prostatectomy without serious results, it is theoretically objectionable because of the tendency to stricture. Murphy (*Journal of the American Medical Association*, March 29, 1902) calls attention to the fact that the removal of the bridge, or that part of the prostate between the urethra and the bladder, is entirely unnecessary, as it shows no tendency to hypertrophy. The so-called third lobe, it should be remembered, is not a part of the bridge, but is a projection from the lateral lobes backward beyond the inner opening of the urethra. By the perineal route the lateral and third lobes can be removed, and by leaving the bridge only a small portion of the floor of the urethra need be sacrificed. Through this opening in the floor of the urethra the bladder should be entered, thus preserving the anatomical integrity of that organ. This is one of the strong points in favor of the perineal route.

The suprapubic operation has been the operation of choice, because within the past few years it has become so popular as the route for lithotomy, and because the third lobe is so easily reached in that way. A surgeon who is competent to perform prostatectomy does not need to have the technique made easy for him, and our present technique of the perineal operation is

not specially difficult. In fact, for the removal of the lateral lobes as found in the majority of cases the technique of the perineal operation is less difficult than that of the suprapubic. The operator's fingers grow longer in this operation as he grows in experience.

Prostatectomy by either route is not ordinarily alarmingly bloody, but when hæmorrhage does occur it is much easier to control in the perineal operation.

In a patient with healthy kidneys the most imminent danger after a prostatectomy is sepsis, and the facilities for drainage after the perineal operation are infinitely superior to those after the upper operation. The suprapubic operation leaves one or more deep ragged holes in the dependent portion of the bladder in which the septic contents of the bladder naturally collect, and infection is very liable to occur. The most successful operations by the suprapubic route are those in which perineal drainage is established. Since the feasibility of removing the prostate through the perineum has been demonstrated, it seems rational to choose this route, thus avoiding injury to the bladder and providing for efficient drainage through the urethral opening and the operation wound. Urine can be efficiently drained off through the upper opening, but the detritus cannot.

Those objecting to the perineal operation claim that there is too little room, and that the prostate cannot be reached. Either the modern inverted Y-shaped or the semilunar incision affords a much better approach to the gland than the suprapubic, and the structures cut through are much less important than the bladder walls. Through these incisions the operation can be performed under the eye, while the suprapubic operation is all in the dark. It has been demonstrated that in the majority of cases the prostate can be readily removed through a straight incision from the scrotum to the anus. Ferguson says that any prostate can be removed through this incision, the secret of success being to keep well within the capsule and to pull or push the gland well down.[1]

[1] Paper read before the Western Surgical and Gynæcological Association, December, 1901.

The writer believes that the perineal route is safer and better than the suprapubic route for prostatectomy in all cases except where either the third or lateral lobes are very soft and vascular and project far into the bladder. The operation is still in its infancy and can be greatly improved. The present operation, in which the gland is pulled down by a staff in the bladder or by hooks and forceps from the outside, is a very great improvement upon the bimanual operation, in which the bladder is unnecessarily injured. In my opinion a complete prostatectomy is seldom the operation of choice. Removal of the lateral lobes and the third lobe when present, leaving the isthmus and preserving the greater part of the prostatic urethra, will relieve our patient's suffering, and will be followed by better functional results. This can all be done in the majority of cases through the median incision. In the exceptional cases where this incision does not afford ample room it can be changed into the inverted Y-incision by adding a lateral incision outward and backward towards the tuberosity of the ischium on either side. These lateral incisions should go down to the perineal muscles, but not through them, and they should not involve the sphincter. This incision gives abundant room, and is not open to the same objections that can be made to other perineal incisions, and it also avoids the mutilation of the unoffending bladder incident to the suprapubic operation. When this incision is made and narrow lateral retractors used, the prostate can be pushed or pulled down so that the parts are as well exposed and as easy to reach as in a vaginal hysterectomy. The writer has found that at the beginning of the operation a Ferguson staff or an ordinary short-beaked steel sound will bring the gland down within easy reach, but that after the capsule is dissected well back it is often an advantage to remove the staff and depend upon instruments with which one can take hold of the prostate and drag it down. A small-sized Hanks vulsellum forceps answers the purpose admirably. When the lateral incisions are made they can be closed up at once.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, April 23, 1902.

The President, L. W. Hotchkiss, M.D., in the Chair.

EPICYSTOTOMY FOR STONES, AND PROSTATECTOMY.

Dr. F. Tilden Brown presented a man, fifty-six years old, who first noticed, in December, 1901, that urination was becoming quite difficult, and shortly afterwards he had an attack of complete retention. A catheter was employed to relieve him, and upon one occasion a searcher was introduced into the bladder under chloroform anæsthesia. Eight or ten days later he developed considerable fever and had several chills. His urine, which up to that time had been clear, became cloudy and foul, and his frequency increased.

When Dr. Brown first saw the patient on January 17 of the present year, he was apparently suffering from a mild degree of sepsis; his general condition was poor, and he was discouraged in regard to his state of health. There was an area of bladder dulness above the pubes, and after voluntarily passing five ounces of urine, which was ammoniacal and foul-smelling, ten ounces of residual urine were withdrawn by the catheter. After two weeks of bladder irrigation, his condition improved so much that a cystoscopic examination was undertaken. This revealed, apparently, a prostatic median lobe about the size of a pigeon's egg, and beneath it a number of smooth, bean-sized calculi. The prominence of the lateral lobes could be slightly discerned, and there was a band of mucous membrane running from the median lobe to the left lateral lobe in such a way as to make it rather difficult to decide whether he was dealing with a large pedunculated off-set

from the left lateral lobe, or a median lobe with this web-like prolongation. But the latter was claimed, and it was proved correct at operation.

After this examination a consultation was held, and the patient was offered the choice of litholapaxy followed by Bottini prostatotomy at the same sitting by one surgeon, and suprapubic lithotomy with prostatectomy by another. The latter procedure being accepted, the speaker operated on February 3, the patient being under chloroform, followed by ether anæsthesia. The bladder was opened above the pubes, and ten stones removed which were partly covered by the median lobe. Then, with the left forefinger pushed into the internal meatus and acting as a guide for the blades of scissors controlled by the right hand, the mucous membrane was cut and the left forefinger forced in the median lobe of the prostate was shelled out and removed. The two lateral lobes were then enucleated with considerable difficulty, and, as they were finally brought to the surface of the bladder, two cord-like bands which held them in place were ligated and divided. The wound in the bladder was then closed with chromicized gut, as well as the upper part of the abdominal incision. Provision for draining the perineal space was made. A perineal opening was finally made for bladder drainage.

Although the blood lost was not great, the patient showed a considerable degree of shock after the operation, which necessitated free stimulation and a saline infusion. The next day he was much better. Two days later he had a chill, and again required stimulation and a saline infusion. His pulse remained rapid and of poor quality, and his general appearance indicated a continuance of shock with a moderate sepsis. As the perineal tube began to cause vesical irritation, it was removed on the ninth day. His perineal fistula healed quite readily, so that all the gauze dressing was discontinued by the twenty-first day. The patient had been sitting up and out of bed for a week, when on the thirty-third day he complained of general soreness and malaise; this was followed by a sudden rise of temperature; the right wrist and left knee-joint became red and slightly swollen, and he was irrational and at times delirious. This febrile condition continued for four days, when the nurse noticed that the bandage covering the perineal wound was stained by a slight discharge of pus. The perineal skin had united in advance of

tissues immediately beneath, causing a small retention abscess and the somewhat alarming constitutional symptoms. Now fever ceased, the joint involvements subsided, and the patient's general condition improved, but his mental state was unsatisfactory. He slept poorly, and was more delirious than he had been, in spite of the use of various hypnotics. He was examined by several neurologists, who attributed his condition to the pre- and post-operative strain on a naturally nervous temperament, as well as a functionally bad heart. He left the hospital about three weeks ago, and since then he has improved in every way. He now sleeps and eats well, and has gained about ten or twelve pounds in weight. He voids his urine about every three hours, and his bladder retains generally one drachm of residual urine; two drachms being the most ever found. It is acid in reaction, quite clear, no trace of albumen, but still contains some purulent flakes, which probably originate in the hyperæmic patches on the bladder wall over the site of the prostatic enucleation and in the posterior urethra. A culture made from the man's urine revealed colon bacilli.

Dr. Brown said that the two cord-like prolongations which held the lateral lobes in place, and which he had ligated and divided, were undoubtedly the ejaculatory ducts, and this fact was often in mind as having a possible bearing upon the man's subsequent nervous symptoms.

In this operation the septum between the lateral lobes in which the ejaculatory ducts run had been carried away by the finger in the process of enucleation. The speaker believes that this should be carefully avoided by seeing that the enucleating finger, after insertion through a single median mucous membrane rent, is then diverted to one side for excochleation of one lobe from its capsules; and before attacking the other side the finger should be withdrawn so as to sweep across the vesical margin of the ejaculatory duct septum before attacking the opposite lobe.

FINAL RESULT OF DELORME'S OPERATION.

Dr. Otto G. T. Kiliani (compare "Total Empyem von zwanzig-monatlicher Dauer, geheilt durch Delorme's Operation," *New Yorker medicinische Monatsschrift*, March, 1900. Paper read before the German Medical Society of New York, January 8, 1900) presented a girl, twelve years old, who first came

under his observation in June, 1899, with the following history: She had an attack of pneumonia on the right side in January, 1898, followed by a pleurisy on the same side, which was aspirated the following month. The child failed to improve, and on the 1st of March, 1898, the pleural cavity was opened between the sixth and seventh ribs and a large quantity of pus evacuated.

When Dr. Kiliani first saw the patient she was much emaciated, very weak, and suffering from marked cyanosis. The right pleural cavity was filled with pus. An immediate operation was done, the seventh, eighth, and ninth ribs resected, and about two litres of foul-smelling pus evacuated. The lung on the affected side was found to be completely flattened. No tubercle bacilli were found in the discharge. The child improved rapidly after the operation, gaining fifteen pounds in weight by the following November, but, as a fistulous opening persisted and the lung failed to expand, it was decided to do the Delorme operation. The outcome of this was extremely doubtful, as the affected lung had been compressed for twenty months. The operation was done on November 9, 1899, the incision for the flap extending from the sixth rib to the tenth rib. The child made a rapid recovery, and left the hospital about two weeks after the operation.

Dr. Kiliani said he showed the case now in order to illustrate to what extent the lung had expanded. At the time of operating, it was practically a flattened mass, while now the breathing over the affected side extends over an area about ten inches long. The child is apparently enjoying excellent health, but there is a marked scoliosis, resulting from the removal of the ribs.

OSTEOMYELITIS OF THE TIBIA.

DR. KILIANI presented a young man who was operated on twenty years ago for double genu valgum, and the wounds, as the scars show, did not heal by primary union. Last October he struck his right leg against a car. The accident resulted in some pain in the affected leg, and finally he was obliged to give up his work. When Dr. Kiliani saw him, on the 15th of March of the present year, he found all the indications of a chronic osteomyelitis of the right tibia, and, upon trephining the bone, pus was detected. An incision was then made over the affected area

and the diseased bone chiselled off. The skin-flaps were then brought over the denuded area and fastened down with carpet-tacks. The wound healed by primary union.

ATYPICAL RESECTION OF THE UPPER JAW.

DR. KILIANI presented a man who, in 1890, developed an alveolar abscess as the result of an ulcerated tooth. The abscess was opened, and the tooth finally filled. Six months later he began to suffer from pain in the left cheek. The trouble was located in the antrum, and a hole was bored through the eye-tooth for the purpose of draining the cavity. Suppuration of the antrum continued, and in 1895, in order to secure more effective drainage, the eye-tooth was extracted, and three openings were made into the antrum,—one through the roof of the mouth and two through the tooth cavity. The following year another operation was performed, and a communication established between the nose and antrum. Three years later this opening was enlarged.

When Dr. Kiliani first saw the patient, on the 15th of March of the present year, the antrum trouble had existed for twelve years. There was a more or less constant accumulation of offensive pus in the antrum, which would finally be discharged through the nose and the various openings in the roof of the mouth. The pain was so severe that the patient had to have recourse to drugs and alcohol. In order to relieve him, a radical operation was done on March 20. The right external carotid was first ligated. This procedure was found a little more difficult than usual, on account of the presence of two glands lying directly over the artery. After extirpating these, a permanent ligature was applied to the artery. Then an incision after the method of Kocher-Weber was made, the flap dissected up, and the roof of the mouth divided in a sagittal direction, starting from the second incisor tooth. The entire anterior surface of the antrum was removed, including the alveolar and nasal processes, and a part of the frontal process. The dissection was then extended along the infra-orbital margin, resecting at the same time the infra-orbital nerve, and removing about one-third of the zygomatic bone. The incision was then carried downward through the alveolar process, the last molar tooth being saved. As the cavity of the antrum was filled with pus, the operation was practically done in an infected region. About a quarter of an inch external to the infra-

orbital foramen, a bony partition was found, which was probably the result of the long-continued inflammatory process. A Röntgen-ray picture of the case, taken previous to the operation, showed apparent ossification of the antrum, owing to the presence of this bony partition.

After destroying with the thermo-cautery all the mucous membrane lining the antrum, the cavity was packed, and the skin brought together and sutured. The incision healed within five days. A few stitch abscesses developed, the result of operating in infected regions.

Since the operation, the patient has been entirely free from the neuralgic pain from which he suffered for many years. He now wears a temporary plate with a perforation, which affords drainage to the rest of the antrum. When the cavity has entirely healed, a plate with artificial teeth will be inserted. There is practically no disfigurement of the face and no impairment of the muscular control.

Dr. Willy Meyer said that cases of chronic empyema of the antrum are rarely seen by the general surgeon until the trouble has existed for a long time, and various ineffectual attempts have been made to relieve the condition. The speaker said that in his opinion the most satisfactory method of treatment is to make a wide opening through the tooth cavity, and treat the case on the dry plan. In one of his cases he was obliged to operate twice through the alveolus, and scrape away a large number of papillomatous excrescences which lined the mucous membrane of the cavity. By the dry method of treatment an absolute cure can usually be obtained in the course of three months. In extreme cases, of course, a more radical operation is necessary.

In the reports of Professor Krause's clinic in Berlin by his assistant, Dr. Halle, it was claimed lately that the best results are obtained by opening the antrum through the lower fossa of the nose, with subsequent dry treatment, and that the cavity should never be entered through the mouth. They have apparently obtained excellent results by this method.

GENERAL PERITONITIS.

Dr. George Emerson Brewer presented a girl, ten years old, who was admitted to Roosevelt Hospital on June 5, 1901, with the history that during the six days preceding her admission

she had complained of pain in the abdomen, with vomiting, and some fever and prostration. Her symptoms had been attributed to some digestive disturbance.

At the time of her admission her temperature was 103° F.; pulse, 128. The entire abdomen was distended, with absolute rigidity of the muscles, and on this account it was impossible to make out the original seat of the trouble. An incision was made in the region of the appendix, and as soon as the peritoneum was opened a large amount of milky pus exuded. The entire peritoneal cavity was apparently filled with this fluid. The appendix was in a gangrenous condition, with perforation, and there were no evidences that nature had made any effort to wall off the infected organ. A second incision was immediately made on the opposite side of the abdomen, and the entire peritoneal cavity was thoroughly irrigated with a large quantity of hot saline solution through a Chamberlain tube. During the course of the operation it became necessary to give the patient a hot intravenous saline infusion.

After completing the irrigation of the abdominal cavity, a large cigarette drain was inserted underneath the spleen, another under the liver, and a third in the pelvis, while the large wound on the right side was loosely packed with gauze. At the completion of the operation, the patient's pulse was 156, and very weak, necessitating free stimulation. During the subsequent four days, she was apparently constantly at the point of death, vomiting incessantly, and so weak that thirty-one stimulating rectal enemata were given. On the second day some of the packing was removed, and again on the fourth day. On the eleventh day, and again on the twenty-third day, the patient was given an anæsthetic and pockets of pus opened. Up to this time the patient's temperature ranged from 101° to 103° F., and her pulse was never under 120. On the thirtieth day her temperature dropped to normal; then it rose again, and did not become normal until the forty-first day; after this there were temporary elevations of temperature until the sixty-first day, when it became normal, and remained so.

Dr. Brewer said that in this case every portion of the greater peritoneal sac was distended with pus. It was one of the few cases he knew of where recovery had taken place after such an

extensive peritonitis. Nearly all the favorable cases have been in children.

Dr. Kammerer said that about two weeks ago he saw a woman of thirty with well-marked general peritonitis, the origin of which he failed to discover after laparotomy. The abdomen was opened in the middle line, the intestines were partially eviscerated and cleansed, and a tampon was introduced into Douglas's pouch, issuing from the lower angle of the wound. The patient recovered.

The speaker said that in his experience the treatment of general peritonitis by incision and irrigation has not been very brilliant; the cases are fortunately not as frequently met with now as they were some years ago in hospital practice. Out of many cases operated on by him, he has only been able to save four in which general peritonitis was really present. The speaker expressed the opinion that the diagnosis of general peritonitis is often made when that condition really does not exist. Unless the operator has convinced himself by inspection of the fact that the entire peritoneum is involved, the diagnosis of general peritonitis is not absolutely certain. This is more especially the case when we are dealing with the adhesive form of peritonitis.

Dr. Kammerer said that in the case he had referred to above, he had drained Douglas's pouch, although, when a general peritonitis exists, he had not much faith in the efficacy of drainage.

Dr. Robert H. M. Dawbarn said that in one or two respects the case called for a little comment. According to the history, an anæsthetic was given on the second day after the operation, and again on the fourth day, for the purpose of removing a portion of the drainage. The speaker said his own experience in these cases has been such as to convince him that when once the Mikulicz or so-called cigarette drain has been put in place, it should remain for a good long while, and that its early removal while pus is discharging is really a mistake, as it opens fresh foci for infection. The fact that such drains have an objectionable smell after they have been in place for a few days is of minor importance. If the patient is apparently improving, with a falling temperature and pulse, Dr. Dawbarn said he would be guided by such factors rather than by the odor, and would let them stink and stay, perhaps a fortnight or longer.

The speaker asked Dr. Brewer whether, in his case, he em-

ployed the postural treatment advised by Dr. George R. Fowler, which is the reverse of that of Dr. Howard Kelly. Dr. Fowler has recorded some fifteen cases which he believes would have ended fatally from septic peritonitis if the patients had not been placed in the upright position, thus allowing the fluids to gravitate towards the pelvis. Dr. Dawbarn said that in two cases where he had resorted to this posture, the effects of it were apparently favorable and the patients recovered. The patient should be placed in an upright sitting posture just as soon as the condition of the heart permits it.

Dr. F. Tilden Brown said the cases which had recovered from a more or less general peritonitis coming under his observation had all been in children, with two exceptions, one a young woman of eighteen or nineteen, the other a man of twenty-four, who, after apparently complete convalescence, became despondent and took his life. There has recently been a tendency to do away with drainage in these cases, the view having been advanced that the peritoneum should be left to dispose of the septic material. In theory, that idea may be all right; but the speaker said he believed that at the time of operating, too thorough or too rapid a cleansing cannot be carried out, and that this should be followed by wick-drainage in all the dependent parts of the peritoneal cavity. Females are more apt to recover from this condition than males, owing to the fact that they so often get the benefit of vaginal drainage. As a rule, this is more effective than any other of the multiple lines of exhaust.

Dr. Brown said that in those apparently hopeless cases of advanced sepsis where, in addition to considerable general peritonitis, we have great distention and probably paresis of the bowel, the open stump of the appendix might possibly be utilized to advantage by cutaneous suture as a colostomy wound for the escape of gas or fæces, and for the insertion of a long tube into the ileum for washing out the lower bowel. The speaker said he had not had an opportunity of putting it into practice.

Dr. Dawbarn said that Dr. Robert F. Weir had already advised the expedient suggested by Dr. Brown, and had resorted to it in a few instances. In a case of chronic colitis, for example, where it is desired to maintain a fæcal fistula for a time, and to flush the ascending and transverse colon, the appendix is dissected free, cut across, and stitched to the skin. Then the catheter

is carried down through the hollow appendix, and thus this otherwise dangerous little reptile for once serves a useful purpose.

DR. KAMMERER said that in general peritonitis he advises washing out the peritoneal cavity with large quantities of hot salt solutions and then closing the wound.

DR. HOTCHKISS said he did not believe that the general peritoneal cavity could ever be effectively drained by gauze packing or any other method of artificial drainage. Personally, in these cases of advancing peritonitis he relied principally upon the physiological forces to effect drainage through the peritoneal lymphatics and blood-vessels, and upon the power of the leucocytes to deal with the remaining infection. He believed that most cases of true general septic peritonitis were necessarily fatal, anyway, and that in any case of generalizing and more or less extensive peritonitis the prognosis depended upon the degree and character of the infection, taking into consideration, of course, the resisting power of the patient, and upon the technique of the surgeon at the operation. In these cases he said it was his practice, having removed the infected appendix and cleansed the immediate neighborhood with peroxide, to wash out the pelvis repeatedly with hot normal salt solution, and, if the infection had extended beyond this, to wash out the general cavity as far as possible with a stream of salt solution, thrown in by a Chamberlain tube, introduced among the intestinal coils and without attempting to eviscerate. He thought that in this way the toxins were diluted and absorption was promoted along physiological channels. Evisceration in any case of this description seemed to him to increase the shock; and the necessary traumatism inflicted upon the intestines by handling, to lessen greatly the absorptive power of the peritoneum. This he thought had been well proven experimentally as well as clinically. As to drainage, he limited it to a small cigarette of gauze enveloped in wet rubber tissue and introduced to the old appendiceal site, and in some cases he introduced also a second and similar cigarette to the bottom of the pelvis. Both drains were removed generally at the end of twenty-four hours or sooner. Under this method of treatment he had had many cases of advancing peritonitis progress to a recovery, and he felt sure that in his experience, at least, more cases had been saved, and the period of convalescence made considerably shorter than was the case where extensive gauze packing had been employed by him.

He believed, also, that the introduction of large pieces of gauze between the intestinal coils was a fertile cause of intestinal obstruction, and a practice not easily to be defended in the light of recent experiment and experience.

Dr. Brewer said he believed in the principle of the elevated thorax posture, which Dr. Dawbarn had referred to, and under certain conditions it might be very useful; but in the case which he had shown, the patient was so extremely weak that he had to be maintained in the recumbent position. Simply raising the head of the bed slightly would have done no good.

Dr. Brewer said that while he believed peritoneal sepsis was the cause of death in these cases, and that drainage was perhaps of little avail, he had never dared to omit it. It is reasonable to suppose that, by relieving the abdominal cavity of large collections of pus by drainage, we lessen the danger of general sepsis. By putting in cigarette drains, we at least remove a fraction of the pus, and to that extent relieve the sepsis.

SARCOMA OF THE PTERYGOMAXILLARY FOSSA.

Dr. Brewer presented a boy, who came to the hospital about a year ago, complaining of pain in the left side of his face, and inability to open the jaw. The left side of the face was much swollen, and the mass, externally, was rather hard and immovable. Inspection showed that the mass also invaded the mouth, but here it was apparently composed of a soft, gelatinous material covered with mucous membrane. The internal portion of the mass was lobulated, and apparently extended as far as the edge of the external swelling.

The patient was examined by a number of men, and the decision was finally reached that the mass was probably a sarcoma which had partially undergone myxomatous degeneration. Upon incising the internal swelling, it was found that it was not a myxoma, but was composed of the ordinary cushion of buccal fat which had been pushed forward by the external growth. The latter was a hard, dense, white, encapsulated tumor, extending underneath the zygoma and into the temporal fossa and the temporomaxillary space. It was about the size of a small orange, and was very hard and lobulated. After removal of this mass, the wound was closed with silk. The boy made an uneventful recovery, and has been in perfect health since.

The pathologist reported that the growth was a fibrosarcoma, not particularly malignant.

Dr. Dawbarn said that, as the growth in this case was encapsulated and not of a very malignant variety, it was possible that there would be no recurrence; but the speaker thought that the patient's prospects of freedom from recurrence would be distinctly better if extirpation of the external carotids had been done in addition to removing the growth. The value of this procedure has passed the experimental stage, even in the most malignant types of subperiosteal sarcoma of the lower jaw, and it does not seem to add much to the severity of the operation. If, however, carotid extirpation was not to be done, at least the speaker strongly believed that a simple double ligation of the external carotids, which can easily be done in five minutes for each side, and with practically no risk, would very soon come to be regarded as an advisable regular preliminary to any and every operation which, such as this of Dr. Brewer, promised otherwise to be very bloody; thereby, by preventing loss of blood, almost all risk of shock would disappear.

HYDATIDS OF THE KIDNEY.

Dr. Irving S. Haynes read a paper with this title.

Dr. Brewer mentioned a case of probable hyatid cyst of the kidney that had come under his observation. The patient was sent to the hospital with the diagnosis of empyema, and a needle introduced between the seventh and eighth ribs on the left side brought pus. Inspection showed an enormous intra-abdominal growth on the left side. An incision was made in the loin, and about a gallon and one-half of pus evacuated. The cyst refilled, and at a subsequent operation it was removed, together with the kidney, with which it was evidently connected. Upon its removal, the kidney and emptied cyst were passed around among the spectators at the operation, and in some manner the specimens disappeared, so that no pathological examination could be made.

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, May 5, 1902.

The President, RICHARD H. HARTE, M.D., in the Chair.

OSTEOTOMY FOR BOW-LEG.

DR. JAMES K. YOUNG presented a girl, aged ten years, who, for the relief of deformity of the left leg, was subjected to osteotomy below the knee three months before.

SUBCUTANEOUS RUPTURE OF THIGH MUSCLES.

DR. OSCAR H. ALLIS presented a man, forty years of age, brakeman, who, on February 15, 1890, was standing on the rear end of an empty box freight car, weight 60,000 pounds, when it was hit unexpectedly by other cars coming slowly against it. The momentum knocked the man down. He fell with his body outside the track, but the advancing car ran over both thighs. The car was an eight-wheeled one, and two wheels passed over the thighs. He was taken promptly to the Presbyterian Hospital, where, on admission, the right limb was greatly swollen and bruised; the left limb much less so. In the right limb the wheel seemed to have passed a trifle above the midlength of the limb; in the left limb the apparent track of the wheel was at the junction of the lower with the upper two-thirds. The skin was not broken in either limb. The swelling was too great to permit of any satisfactory examination. Peripheral sensation was lost in the region of the injury to right limb, but not in the left.

Two weeks after the injury the hæmatoma broke down and was evacuated. No part of the skin sloughed in either limb. He was discharged at the end of thirteen weeks. Result, sensation returned to right limb; function so completely restored that the usual recklessness of brakemen was again indulged in, viz., the jumping on and off cars while in slow motion.

FIG. 1.—Spina bifida, five weeks old.

FIG. 2.—Spina bifida, after excision of sac.

The track of the wheels can now be distinctly seen as two broad shrunken belts. When the patient contracts the flexor muscles, they act as two-bellied muscles, especially marked on the right limb.

Dr. Allis said that there was no reason to dispute the accuracy of the history of the injury. The car was marked, weight, 60,000; it was moving slowly; only two wheels passed over him; the clothing, which was his only protection, consisted of winter pantaloons and drawers.

OSTEOPLASTIC OPERATION FOR SPINA BIFIDA.

Dr. De Forest Willard presented an infant who at birth presented a large sessile tumor, lumbosacral, skin ulcerated. When seen at five weeks, epidermis had formed over the tumor, which was two and one-half inches in diameter; tensely distended during crying. Pressure upon the sac gave distress to the infant. The lower limbs were partially defective in motion, but not totally paralyzed, and there were no deformities of the legs. Condition of sphincters not ascertainable on account of age, but there was no apparent control of either bladder or rectum. In the centre of the sac was a dimple, apparently the attachment of the cord.

Operation at five weeks. A V-shaped portion of skin was excised, and the skin thoroughly dissected back from the sac. Upon opening the sac, the entire cauda equina was found adherent to the posterior wall; the filaments were dissected free and replaced in the spinal canal. A large section of the sac was excised, the remaining lateral portions being brought together over the large opening in the canal, which was an inch in length and three-quarters of an inch in width; spinous processes and laminæ being entirely absent. Redundant lateral portions of the sac were closely stitched with a continuous suture of catgut, the edges being inverted, and a staple stitch employed. Next, two large osseous flaps were cut from the crest of the ilia with a strong knife and turned inward upon their periosteal bases like a cellar-door, the fresh surfaces presenting outward. These were firmly united with catgut, and the opening in the canal thus accurately closed. The flaps of skin were then brought together and sutured in the same manner. The wound was dusted with aristol, and a dry aseptic dressing applied. The wound was protected from soiling

by enclosing the gauze within a superimposed piece of mackintosh, accurately sealed and united around its lower and two lateral margins by freely applied layers of collodion, the collodion being applied first to the skin over one half an inch in width around the margin, the mackintosh then laid in place and sealed thoroughly. By the use of this dressing combined with keeping the child upon its face and an abundance of absorbent cotton about the genitals and anus, all infection was prevented and primary union secured. The child suffered less discomfort after the operation than before; nursed and slept well, and recovered in two weeks. The tumor has not reappeared and the opening seems to be strongly closed, but the child is apparently becoming hydrocephalic, a not uncommon sequel. The legs show no change.

INTESTINAL ANTHRAX.

DR. DE FOREST WILLARD made the following report to complete the history of the case of anthrax reported by him in the ANNALS OF SURGERY, April, 1902, page 524.

The man, a leather worker, had been infected in the cheek and also in the intestines. The wound caused by excision of the cheek tissues healed speedily; after a long struggle, in which his life was in the balance for weeks from peritonitis from the intestinal infection, opening of the abdomen and evacuation of three quarts of pus caused slow improvement, the sinus closing in five months. Meantime he suffered greatly from intestinal pains, probably due to the adhesions of loops of intestines about the abscess wall; but these pains, together with the symptoms of partial obstruction, were slowly relieved, and he was discharged from the hospital in six months, apparently in good health.

EPITHELIOMA OF THE ORBIT; TREATMENT BY X-RAYS.

DR. WHARTON presented a woman who, for a number of years, had been suffering from an epitheliomatous growth which first appeared below the right eye, involving the lower lid. It gradually extended, until she was sent to the hospital under his care two months ago. At this time she had a very large growth, which extended beyond the limits of the orbit and had destroyed the right eyeball. He curetted the growth, removed the shrunken eyeball, cut away the edges, and then applied the X-rays from

five to ten minutes at intervals of two to three days. She has had in all twenty applications, and there has been marked improvement in the condition of the parts. A large amount of cicatrization has occurred.

ARTERIAL ANGIOMA OF THE EAR AND NECK.

Dr. Francis T. Stewart reported a case of cirsoid aneurism occurring in a medical student aged twenty-two years; he had been born with a nevus on the left ear, which grew with a rapidity out of all proportion to his general development. Hardly a month has passed without some hæmorrhage from the angioma; at times the bleeding would occur during sleep and often a large quantity of blood would be lost. For several years a bandage has been continuously worn around the head, owing to the constant dread of severe bleeding. The patient is unusually intelligent, quick and nervous in action, and markedly anæmic, owing to the repeated hæmorrhages. Occupying the site of the left ear and that portion of the neck immediately below it was an irregular swelling, purple in color, measuring six inches longitudinally and three inches laterally, the width of the mass lessening in the lower part. The whole swelling pulsated with considerable force, there being a number of arteries—the largest about the size of the radial—which ran into the mass, and which by their twisting and sacculation constituted most of the swelling. The skin was infiltrated with numerous enlarged venous capillaries. Pressure on the carotid caused a material diminution in the size of the tumor, but did not stop pulsation. Under ether anæsthesia an incision was made around the periphery of the angioma; each vessel was ligated as it was encountered, and all the vessels and overlying skin below and behind the ear were excised. The cartilage of the ear, which had been pushed forward by the growth so that it projected perpendicularly from the side of the head, was next sutured to the periosteum of the skull, and the incision closed except for a small area just below the ear, whose margins could not be approximated and which was allowed to granulate. The operation lasted three hours, was attended by frightful bleeding, although compression of the carotid was practised, and was followed by much shock. The patient was satisfactorily reacted, however, by saline infusion and stimulants, and the wound healed without mishap. The only vestige of his former trouble is a slight bluish discoloration occupying the region of the lower ear.

ADVANCED CARCINOMA OF THE BREAST.

Dr. Stewart presented a woman, aged forty-five years, who had noticed a hard lump about the size of a hazel-nut just to the inner side of the nipple three years before coming under observation. This increased very slowly in size for one year, when the rapidity of the growth became accelerated, until the entire breast was the seat of a hard mass. The skin covering the breast had ulcerated, the huge tumor resembling a crater. The axillary lymph glands were swollen and the growth was adherent to the pectoralis major muscle. The breast, both pectoral muscles, and the axillary glands were excised, and the wound closed by raising large flaps from the belly and back to fill in the deficiency left by the removal of the mass. The temperature remained about normal for three weeks after operation, and the tip of one of the flaps sloughed, leaving an area about the size of the palm to granulate. His object in bringing this case before the Academy was to show the result after the Warren method of the closing an enormous wound following an extensive excision of the breast, and also the amount of comfort gained for a patient subsequent to an operation for a breast cancer which might have been considered inoperable. The operation was performed ten months ago, and there were no signs of recurrence thus far.

Dr. Allis said he had had infection in every case in which he had to do this operation, and the reason was this: the surgeon takes away the great and small pectoral; that leaves a space which is bridged over by the clavicle which stands out so that when the skin is brought over there is left an air-space which invites infection.

One of his cases was quite unique and interesting; the shoulder-joint approximating the operation became infected. He drained right through the joint, washing it out, and in the course of five or six days removed the drainage. She recovered perfect use of the shoulder.

Dr. Rodman said that one of the patients who was shown to the Academy by him fifteen months ago is now dying from recurrence. But in another case, operated four years last October, the third operation, a most extensive operation for a recurring scirrhus growing from the sternal portion of the mammary gland, the patient is entirely well to-day.

In yet another case reported to him last month, the patient is well a little more than four years, having been operated in December, 1897.

SUPPURATIVE CHOLECYSTITIS DUE TO THE TYPHOID BACILLUS.

DR. GEORGE ERETY SHOEMAKER reported the case of a woman, aged thirty-three years, who was seen at her home by Dr. Xander for an inflammation in the region of the gall-bladder. She had had six confinements without sequelæ, and had aborted two months before at three and one-half months of gestation, while suffering from a severe attack of typhoid fever in the Methodist Hospital. During this attack, which began October 15, 1901, there were noted, as confirmatory of the diagnosis of enteric fever, the Widal reaction, spots, tympany, and typhoid stools. Though dangerously ill, she recovered fully and remained well four weeks. Then began, December 27, 1901, the present attack, with soreness and pain in taking a long breath, two or three inches to the right of the median line and above the level of the navel. Turning in bed gave severe pain. No cough, chill, or jaundice. There was absolutely no previous history of a gall-stone or gall-bladder attack. A mass below the rib edge was noted by the patient two days later. Her temperature ranged to 101° F., pulse to 110. There was some perspiration. When seen January 2, 1902, by the writer, a distinct mass could be felt to the right of the median line below the rib edge; the upper half of the right rectus muscle was rigid, the lower abdomen was tympanitic; the tenderness was greatest over the gall-bladder, less over the appendix, and absent on the left side. Vaginal examination was negative; there was no jaundice, no vomiting. She was sent to the Presbyterian Hospital for operation; diagnosis, cholecystitis with abscess. Leucocyte count, 15,200. The pain was very severe during the night. Next day, on opening the abdomen vertically over the mass, no adhesions were found to the parietal peritoneum. The liver, gall-bladder, and neighboring viscera were massed firmly and covered with well-organized exudate. The recognition of the gall-bladder was a matter of some difficulty; but without separating its adhesions, after proper packing, it was opened with great ease by a blunt dissection and about two ounces of pus allowed to escape. This was yellowish, streaked with blood

and contained small clots; the portions escaping last contained mucus, but no bile. The walls of the gall-bladder were about one-eighth inch thick, much softened by inflammation, and of a purplish red inside; they bled on the lightest touch, so that small clots, constantly renewed, concealed from recognition by the finger a solitary gall-stone, which was, however, afterwards found and removed through the wound. It had no facets. The gall-bladder opening was stitched in the wound and drained. There was no complication in the recovery, and the patient left the hospital on the twenty-sixth day with a small sinus discharging a very little mucoid secretion from the gall-bladder wall. No bile.

A culture made by Dr. Foulkrod, under the supervision of Dr. Steele, in the laboratory of the hospital, gave a pure culture of a bacillus identical with the typhoid bacillus.

Four months later the patient is strong and well, doing her own work, including washing, without any discomfort whatever. The sinus still persists, a very little mucopurulent fluid staining the dressing. When it closes, she feels some discomfort, and she therefore re-opens it. Only once since the operation has anything resembling bile appeared, when about six weeks ago a few drops of greenish fluid escaped for a week. The cystic duct appears to have been obliterated by inflammation. No gall-stone can be now found.

INTERSCAPULO-THORACIC AMPUTATION.

Dr. Le Conte read a paper with this title, for which see October number of the Annals of Surgery.

Dr. W. L. Rodman said that he did not think that the weak and excessive heart action in this case was entirely due to hæmorrhage. The pulse was 120 before operation, and the man was known to have Graves's disease, than which nothing produces a more irritable heart. Furthermore, one should not forget the rapid dismemberment, and the additional fact that limb and tumor weighed fifteen pounds. The existence of Graves's disease and the rapid amputation were as potent factors in producing shock as the hæmorrhage. The subsequent behavior of the case would seem to prove it.

Dr. Le Conte thinks that he made an error in ligating the first portion of the subclavian, and in this opinion Dr. Rodman

concurred. Ligations of the first and second portions of the subclavian have been looked upon as undesirable, if not very generally unjustifiable procedures. He who does them goes into a hornet's nest. The artery is so intimately surrounded by important veins and nerves, and, moreover, gives off all of its large branches from the first portion, that both primary and secondary hæmorrhage are greatly to be feared. The pleura beneath is very apt to be wounded, as in this case. Still, in spite of difficulties seemingly almost insurmountable, the subclavian has been successfully ligatured in its first portion. A vast majority of such cases have, however, been fatal.

Had Dr. Le Conte attached the vessel in its third portion, as he now suggests, the operation would have been both an easier and a safer one. Dr. Rodman also questioned the wisdom of removing the entire clavicle, unless it be diseased. He should feel safer in dividing the bone where it is smallest, at the junction of the outer and middle thirds, by means of a Gigli saw, which can so easily be slipped under the bone. In this way there would be little to fear in the way of hæmorrhage. The inner end of the clavicle is a dangerous region, and one to avoid when possible. Should Dr. Le Conte modify his operation so as to ligate the third portion of the subclavian, and remove only the outer third or half of the clavicle, he will then have an easy and safe procedure.

Dr. Le Conte said that his object in recommending the disarticulation of the sternal end of the clavicle was to give the largest possible exposure for the ligation of the vessels, and the procedure certainly accomplishes this well. The question of resecting or disarticulating resolves itself into the following consideration. If the veins are of normal size and normal relations, a resection of the clavicle will probably give all the room required for safely dealing with them, but if they are much increased in size or of abnormal relationship, a disarticulation of the sternal end of the clavicle is more safe, for it gives a much larger field for their ligation. No one can possibly tell before operation the size and relationship of the veins. In malignant disease, they are usually much increased in size, therefore the largest possible exposure will be the safest procedure.

Owing to the many difficulties encountered in this operation, even in the hands of the most skilful surgeons, he felt that there

must be some better way of exposing the vessels than by the use of Berger's method. By disarticulation he got a better exposure, but perhaps at a greater risk of wounding the important structures at the root of the neck. If one omits the disarticulation of the clavicle, the same incision as proposed above will give a fair exposure of the axillary vessels, provided the costal section of the pectoral muscle is severed in the axilla, and the pectoralis minor is divided and reflected upward, but it will not expose the anterior scalene muscle or the junction of the cephalic with the subclavian vein. In other words, it exposes the vessels too far out to eliminate all the dangers of hæmorrhage. As yet he had experienced no difficulty in disarticulating the sternal end of the clavicle without opening the deep layer of the deep cervical fascia, and no harm can come to the vital structures in this region unless this deep layer is opened. (*Vide* Transactions of XIII International Congress, Paris, 1900, Section of General Surgery, p. 467.)

TRANSACTIONS OF THE CHICAGO SURGICAL SOCIETY.

Stated Meeting, April 7, 1902.

ARTHUR D. BEVAN, M.D., in the Chair.

LYMPHOSARCOMA OF THE RECTUM.

DR. WILLIAM HESSERT presented a man upon whom he had operated for sarcoma of the rectum. The patient presented himself to him the beginning of last July, with a history of having had symptoms referable to the rectum for five months before that time. He experienced a steadily increasing sense of fulness in the rectum; pain at times when he sat down, as his occupation, that of a tailor, demanded. He was fifty years of age. There was a slight discharge of blood sometimes, with a gradually increasing sense of weakness, and some loss of weight. Further than that he had no symptoms. Patient thought himself afflicted with hæmorrhoids. General physical examination was practically negative. Digital examination of the rectum encountered a large tumor mass situated about one inch above the anus and springing from the posterior rectal wall. The finger came upon a mass, and, owing to its size, it was impossible to feel the upper pole. One could palpate a smooth, slightly movable body, traversed by a large sulcus, not very tender, and this was all that could be elicited by examination. There was no enlargement of the inguinal glands. The part of the rectum bearing the tumor was removed by a modified Heinecke operation. At the expiration of nine months, the patient is in good condition. The tumor was examined by Dr. M. Herzog, who pronounced it to be a lymphosarcoma.

DR. DANIEL N. EISENDRATH had never seen a case of sarcoma of the rectum, but had observed several cases of sarcoma of the small intestine. He said Kundrath had called attention

to cases of lymphosarcoma of the alimentary tract. The case reported by Dr. Hessert was interesting in that the disease apparently pursued a more benign course than was the case in many other sarcomas. In a specimen which he saw Kundrath exhibit, the entire stomach was about two inches thick from cardiac to pyloric end, showing the uniform progress of the growth, with adhesion to other viscera, such as would be expected from carcinoma elsewhere.

Dr. Alexander Hugh Ferguson had never seen a case of lymphosarcoma of the rectum, but he had noticed sarcoma of other parts of the alimentary canal. He removed a sarcoma of the cæcum about ten years ago. He thought the case reported by Dr. Hessert showed the comparative benignity of these tumors in the rectum.

Dr. L. L. McArthur said that the first time one utilized the Kraske incision or modifications thereof, such as had been made by Hochenegg and others, it seemed a rather formidable operation and a crude way to approach the rectum, but it enabled the surgeon to get at the entire rectal tube, and one became more pleased with it except in those cases in which tumors occurred in the female; then the vaginal route could be readily utilized.

During the past week he had removed by a Kraske incision a tumor which involved the posterior wall of the rectum, capable of being reached at its upper limit by strong pressure on the perineum with the finger, involving only about one-half of the circumference of the rectum, and it was quite feasible through the Kraske incision to remove the growth without making total resection of the rectum. He believed that it was the route to be chosen when the growth was situated on the posterior wall, and when it did not require total resection of the rectal wall. From that situation it was far more feasible to reach the involved lymphatics that lay along the mediosacral line than it was by the vaginal route. But in the female, where total resection of the rectal wall was contemplated, then he believed that an incision in the posterior vaginal wall, splitting and laying it back on each side, enabled one to amputate the rectum beneath the growth, to pull it towards the symphysis, get at the entire rectal wall with a hold on it, and with a means of handling it that could not be done by a Kraske. It was hard through the Kraske incision to handle the rectum when it still remained attached to the anus.

In the case he operated on during the week, he made a suture after the Heinecke-Mikulicz method of the long axis of the wound in the bowel, and brought it from above downward, so that no stricture could result.

As to sarcoma of the intestinal tract, he did not recall ever having seen such a case. He had seen one case of supposed sarcoma of the cæcum, but this turned out to be tuberculosis.

DR. ARTHUR DEAN BEVAN said he had found great difficulty in two cases where he made rectoplasty for stricture on the same plan as a Heinecke-Mikulicz pyloroplasty, dividing the stricture longitudinally and uniting it transversely, in getting primary wound healing. He was rather inclined to believe that this was a location where it was difficult to get union in the rectum. These two cases he had ran along very well for six or eight days, with no evidence of suppuration, then later broke down, with formation of a fistula. On the other hand, twice, in making a resection of the rectum, bringing the rectum out entirely through the sphincter and making an end-to-end anastomosis with deep mattress sutures, and then whipping the mucosa together with a fine continuous suture, he had obtained ideal union. This experience led him in this line of work to adopt such a scheme as this rather than a rectoplasty in a similar case. He did not think the method could be applied in the case of Dr. Hessert, unless he first amputated the tumor, then turned the rectum inside out, and this would necessitate using the peritoneum and ligating the mesocæcum. Weir, in a report made about a year ago, found he had obtained in his rectal work much better union by making end-to-end anastomosis after passing the rectum through the sphincter than in any other way.

URANOSTAPHYLORRHAPHY.

DR. ALEXANDER HUGH FERGUSON read a paper on CLEFT PALATE, and exhibited a patient upon whom he had performed a uranostaphylorrhaphy at one sitting, securing good result. For this paper, see the October issue of the ANNALS OF SURGERY.

FIBROSARCOMA OF THE ILIUM.

DR. A. E. HALSTEAD showed a specimen of sarcoma of the ilium which he had removed from a boy, eleven years of age, about one year ago. Microscopical examination showed the tumor

to be a sarcoma. The tumor grew from the ilium close to the sacro-iliac joint of the right side. The tumor compressed the sciatic nerve, and a portion of it projected into the obturator foramen, and pressed upon the obturator nerve, causing symptoms simulating hip disease. Patient was examined a number of times and treated for months for hip disease. He had the characteristic limp of a patient with tuberculosis of the hip. There was atrophy of the muscles, pain in the knee, and slight elevation of temperature. The only feature which argued against hip disease was the absence of rigidity of the hip muscles. On rectal examination the tumor was felt, but could not be palpated until the patient was under an anæsthetic.

The tumor was removed by making a long incision parallel with Poupart's ligament, running back behind the anterior superior spine along the crest of the ilium, turning the peritoneum over and enucleating the tumor extraperitoneally. The iliac vessels were stretched over the tumor, very much enlarged, and it required considerable time to separate the vessels from the tumor without doing damage. The tumor was easily removed. The iliac vessel was pushed towards the inside from the tumor, which was separated from the bone by chisel, taking a layer of the bone with the tumor. The boy made a good recovery, having gained the use of his leg perfectly. The tumor proved to be one of fibrosarcoma growing from the sacro-iliac synchondrosis.

Dr. Arthur Dean Bevan said that he saw Schauta, in Vienna, remove a similar tumor from the ilium and ligate the common iliac artery and vein at the same time, and, very much to his surprise, there was no gangrene following a complete operation. The common iliac artery and vein were so situated that the tumor could not apparently be removed without taking a section of them out. This was done, and no gangrene whatever followed.

ANEURISM OF THE SECOND PART OF THE RIGHT SUBCLAVIAN.

Dr. Halstead also reported briefly a case of aneurism in which he ligated the first part of the right subclavian for an aneurism of the second part. It was now two and a half years since the operation was done, and the patient is perfectly well, without any subsequent peripheral gangrene.

VALVE FORMATION IN THE LOWER PORTION OF THE URETER.

Dr. William E. Morgan read a paper with the above title, for which see the October issue of the Annals of Surgery.

Dr. Alexander Hugh Ferguson recalled a similar case to the one narrated by Dr. Morgan, where the stricture was due to a stone; but there was also a small stricture at the opening of the ureter into the bladder. This stone was so small that it could not be detected by cystoscopic examination, but with two fingers in the rectum and a sound in the bladder he felt a foreign body there. This case came under his observation before the advent of the X-ray as an aid in such examinations. There was also an enlarged kidney with pus in the urine. Patient had had frequent attacks of pain, hæmaturia, etc. He explored the kidney first through an oblique lumbar incision, and found both the ureter and kidney enlarged. He did not open into either, but went down in the direction of the inguinal canal, or in the direction of the lower fourth of Dr. Morgan's incision, and removed the stone from the ureter at that point. He cut off the ureter at that point and reimplanted it into the bladder with two rows of sutures, and with three or four stitches attached it to the mucous membrane, then inverted the bladder, rolling the whole end of the ureter into the bladder at one sitting. The patient made a good recovery.

He had another case where there was a uretero-abdominal fistula. He went through the right rectal wall and transplanted the fistulous opening which led into the abdominal cavity, with all the cicatricial mass, pushed that into the bladder and sewed it there, with a good result.

One of these patients was a long time under the anæsthetic, between two and three hours. This was a great tax upon the kidneys. He criticised the use of ether in such cases, saying that chloroform ought to be used, as with it there was less tendency to suppression of urine afterwards. This he had demonstrated to his own satisfaction in the last year.

Dr. L. L. McArthur thought that the incision separating the external oblique muscle, parallel to its fibres in the position shown by the cicatrix, enabled one to reach that portion of the ureter which the essayist had mentioned readily, and that it was unnecessary to make the two wounds communicate. He thought,

therefore, that where the muscles were separated at a distance of three to four inches from end to end, it would enable one to get at all parts of the ureter, leaving a considerable portion of the abdominal wall yet uncut.

DR. ARTHUR DEAN BEVAN said that he had seen one case of death after ligating the common iliac artery, which he felt at that time was largely due to the very extensive stripping up of the peritoneum, so lowering the vitality of the tissue that infection was made more probable, and in handling the peritoneum, as surgeons did so frequently, it seemed to him cutting directly through the peritoneum would make that step of the operation easier and do away with the difficulty, mentioned by Dr. Morgan, of avoiding the peritoneum or tearing into it. He was impressed with the fact that the bulk of this ureteral work, which was done by gynæcologists, had been done through the peritoneum. Most surgeons were agreed now that ligation of the iliac arteries was done best by the transperitoneal route.

DR. MORGAN, in closing the discussion, and in answer to Dr. Bevan, said he had some fear in handling the peritoneum in his case. Not knowing what he was going to find and how much he would have to open the pouch, which had been for several months drained and which had already become infected, he felt all the more fear for the peritoneum; and in anatomical experiments on cadavers which he made a good many years ago, before much of the low ureteral work was done, he continually searched the pelvis to see how much he could do without hurting the peritoneum in this neighborhood, and it occurred to him at that time that almost anything in the nature of operating on the seminal vesicles, the pelvic portion of the spermatic cord, and the bladder, as well as dealing with the pelvis and the lymphatics in the pelvis, could be undertaken extraperitoneally.

DR. DANIEL N. EISENDRATH read a paper entitled "Traumatic Rupture of the Spleen."

DR. WILLIAM E. MORGAN had seen but one case of rupture of the spleen, and this was in a cadaver. There was no history of any injury. The man was a tramp, who was found dead in the woods, with his coat tucked under his head for a pillow. The post-mortem examination revealed an extensive rupture of the spleen, with a great deal of blood and blood-clots in the

general peritoneal cavity. The spleen, however, was much larger than normal, and he thought it might have been an ague spleen.

Two years ago he did a splenectomy for splenomegaly. The spleen was very large. He was unable to obtain a clear and definite history of the case. He thought it was a syphilitic spleen because the patient had improved under the use of iodide of potassium and mercury. In this case, in separating a small adhesion posterior to the spleen from the peritoneum, he encountered the most profuse hæmorrhage he had even seen in any operation. A sterile towel was rapidly grabbed and crowded in between the spleen and peritoneum. He thought this saved the patient's life. The towel was left in for two or three days. He thought this case emphasized the point as to how small an injury of the spleen would produce an enormous amount of hæmorrhage.

Dr. Alexander Hugh Ferguson said that in the spring of 1891, a man, in alighting from a street-car, was run into by another man who was riding a bicycle, the patient being struck by the bicycle over the spleen. He saw him about two hours after the accident occurred. Patient was in shock, without evidence of any external injury. There was no tenderness over the spleen or over any of the other abdominal organs that could be detected. In twenty-four hours a tumor appeared in the region of the spleen. At this time patient rallied from the shock, after having been given strychnine, salt transfusion, and so on, but the tumor increased in size, after which the symptoms of shock reappeared. The symptoms became more and more grave, and it was only within forty-eight hours thereafter that he made up his mind it was a case of rupture of the spleen without rupture of the capsule. He proposed operation, but it was refused. The tumor had increased to such a large extent until it reached to the iliac crest and below the umbilicus, then suddenly ruptured, followed by death of the patient. Two other physicians saw the patient in consultation, and it was only after they had refused to sign a death certificate that a post-mortem examination was permitted. This examination disclosed complete pulpification of the spleen, so that he could not discern which was blood-clot and which was spleen.

Dr. Thomas A. Davis said that the great mortality of subparietal rupture of a viscus which could be removed with a mortality of less than five per cent. by general splenectomy was appall-

ing at this day in surgery, and it was largely due to errors in diagnosis and to delay in operating. He thought the whole question of injury to the abdominal viscera was involved, particularly in the light of Morris's observations, who had experimented on the kidney and had developed the fact that rupture of the kidney was due to hydraulic pressure. Grawitz and others had experimented upon the kidney in attempting to rupture it by blunt instruments, and were unable to injure the kidney. The speaker himself had made experiments on the cadaver recently. The body was held in the erect position, and with a hammer he attempted to deliver a blow, such as might be given by the kick of a horse, and he was unable to rupture the hollow viscera. He ruptured the colon, but was unable to injure the solid viscera, and he attributed the injury to the colon to the fact that it was under gaseous tension, and had indirect contact with the blow. Grawitz was unable to rupture the kidney from external violence. Morris took the kidney from a cadaver and threw it upon the floor, without being able to injure it, except to produce a slight abrasion of its surface. By injecting the kidney, ligating its vessels, and throwing it upon the floor, he produced multiple fractures. The lines of fracture conformed to the lines found in ruptured kidney during life. These organs, which were so delicate in the frame-work and contained such an amount of blood, were easily fractured by hydraulic force.

The whole question of subparietal injury to the abdominal viscera was involved because of the difficulty of differential diagnosis. A large blunt instrument, applied directly over the spleen, might rupture the liver or the kidney; and how to make a differential diagnosis was exceedingly difficult, if not impossible. The lesson to be learned was that if a patient presented the picture or history of a severe shock, and did not react from the shock, as a patient would who had not received a grave organic injury, an immediate operation should be done for diagnostic purposes.

Dr. L. L. McArthur said that in his hospital service, four or five years ago, he had the case of an elevator boy who accidentally fell down the elevator shaft, striking on the top of the elevator. He fell one story, striking a cross-bar ledge. The boy was brought to the hospital in shock, with physical signs which led Dr. McArthur to believe that there was fluid in the peritoneum. The history led him to believe that the boy was

having an internal hæmorrhage. He made an incision in the median line, to the side of the umbilicus, and found a large quantity of blood in the abdomen, and traced its source to a lacerated spleen. The capsule was torn and bleeding. He tried to stitch it, and found it impracticable, but with a mechanical tampon, used after the manner of a Mikulicz tampon, he succeeded in checking the hæmorrhage, and the patient recovered. He thought an attempt should be made by pressure at least to stop the hæmorrhage, for a few hours, from the spleen before excising the organ. Hæmorrhages from the liver and from the spleen, in his experience, can be readily stopped unless the laceration extends into the large vessels at the root of the spleen. The towel pressure, mentioned by Dr. Morgan, led him to think that many cases of splenic hæmorrhage could be arrested by mechanical pressure, aided by the calcium chloride solution, moistening the tampon with that, or suprarenal extract in addition to that.

He thought it was wise to explore the abdomen early in cases of suspected injury where profound shock was present, rather than to wait, but he would hesitate about excising a fairly normal spleen unless the hæmorrhage showed no indication of being arrested by compression.

Dr. Arthur Dean Bevan said he had had two cases of rupture of the spleen, both of them having recovered. One was a malarial spleen, the patient having come under his observation in Portland, Oregon. The other case was a spleen which ruptured about six months ago at the Presbyterian Hospital. Neither of these cases was operated on in the sense that the spleen was removed. The first case was seen about a week after the injury. The abdomen was greatly distended with fluid. The fluid was removed through a small incision, a small drain introduced, and the patient recovered.

The second case was referred to him by Dr. Herrick about six months ago. The patient, a Greek, was struck by another Greek with a stone about the size of one's fist, striking the patient in the region of the spleen and producing a contusion. The symptoms were those of shock. A large amount of blood was found in the abdominal cavity. The disappearance of liver dulness led him to believe that there might be a perforation of the alimentary canal. Considering the tympany which was found in the case, he eliminated rupture of the alimentary canal, and

made a diagnosis of rupture of the spleen. The man was given salt solution subcutaneously, pressure was made upon the abdomen, cold compresses applied, strychnine administered, and he went on to recovery with one complication, which was that sapræmia developed from the large amount of blood in the abdominal cavity. A laparotomy was made, the blood washed and drained out, but nothing done with the spleen.

He had gone over the literature of injuries of the spleen, and was not at all convinced that the operative treatment for rupture of the spleen, particularly the removal of this organ, was warranted. The statistics would not lead one to that conclusion.

Dr. Eisendrath had said there were four well-authenticated cases of recovery on record after rupture of the spleen. The speaker thought this hardly represented the facts, according to the report he (Bevan) had given to-night. There was no question about either of the two cases he had mentioned. He thought there were a great many cases of rupture of the spleen which were not reported, and not operated, that had recovered. He was inclined to believe that we could not come to the conclusion that splenectomy should be performed when a diagnosis was made of rupture of the spleen any more than that an immediate operation should be done following a diagnosis of perforating bullet wound of the stomach. Many of the cases of rupture of the spleen, when seen, were in such condition that a laparotomy would mean death. On the other hand, many of them recovered without operation for the removal of the spleen. Furthermore, splenectomy was by no means a minor operative procedure. The operation itself produced a great deal of shock.

He thought Dr. Morgan's case, and a number of similar cases, showed how readily bleeding could be controlled by pressure.

Dr. Eisendrath, in closing the discussion, and in reply to the remarks of Dr. Bevan, said that when he approached this case the thought had entered his mind to which Dr. Bevan referred, namely, would the boy live if let alone, and took his chances of absorption of the blood? He recalled one case which entered St. Thomas's Hospital five days after the injury, the patient having been run over by a hansom cab. He recovered from the immediate effects of the injury, then suddenly went into collapse, and died.

As regards splenectomy, a good deal depended upon the extent and position of the tear. If the tear involved the hilus, so that the vessels were torn close to the entrance into the spleen, the surgeon could not do much but splenectomy. If the tear was on the upper or lower pole, tampon would be indicated. The only reason he did not try tampon was because of the boy's bad condition, and he adopted the quickest procedure. He removed the spleen in a minute or two without any difficulty. In his paper he had tried to confine himself as much as possible to traumatic injury of the spleen where this organ had been previously normal.

INDEX TO SURGICAL PROGRESS.

GENERAL SURGERY.

I. Cancer Parasites. By Dr. H. Noesske. A special group of cell inclusions have been described by various authors, especially Plimmer, as parasites. Noesske has found these in various gland cancers, especially in mammary carcinomata, while he has missed them entirely in epitheliomata. These bodies have nothing to do with parasites, being characteristic vacuolated formations, the development of which Noesske has followed step by step. They begin in the form of fine vesicles in the protoplasm, generally close to the cell nucleus, contain a substance capable of coagulation, and, according to the amount and concentration of this material, go on to the formation of one or more granules (usually central) and of the characteristic peripheral contours. Often fine fibres and clots are recognizable scattered within these bodies. They may be found in benign growths and in normal gland tissue.

The similarity of the cell inclusions to the myxamœba stage of Plasmidiophora brassicæ (the cause of Kohl hernie) is only superficial and apparent. The cancer parasites recently described by Feinberg are identical with Plimmer's bodies, and cannot withstand earnest criticism. To-day there is no proof of the parasitic origin of cancer. The author doubts the correctness of the statistics which show an apparent increase in the prevalence of cancer.—*Verhandlungen der deutschen Gesellschaft für Chirurgie*, 1902.

II. Micrococcus Neoformans and the Treatment of Cancer. By Dr. E. Doyen (Paris). On November 25, 1901, Doyen announced to the Academy of Medicine the discovery of a round

microbe arranged in chains of six or eight links, which he found in cancers, and especially in cancerous lymph glands. The microbes are difficult to cultivate. If they are cultivated on a suitable medium, they may afterwards be transplanted to other media. On agar-agar they form a grayish, viscid scum and slowly liquefy the gelatin. The organism is destroyed through a twelve-hour exposure to a temperature of 55° to 60° (130° to 140° F.). Cultures are most readily obtained from points remote from the original focus of the disease, *i.e.*, the centre of the cancer is very often sterile. In sections it is difficult to demonstrate the micrococcus, yet it can be done with thionine or safranine. Gram's method combined with carmin shows a small number of single or double diplococci.

Doyen has found the organism in the most varied tumors,—in cancer of the breast and its lymphatic glands, in cancer of the uterus, stomach (secondary nodules, also), of the ovaries, rectum and its peritoneal metastases, in proliferating cystomata of the mammæ and ovaries, in rapidly progressive struma of the thyroid, in pleural sarcomata, in spindle-celled sarcoma of the cervical glands, in muscle sarcomata, and in rapidly growing lipomata of the vas, etc.

In another list of tumors no cultures were possible. In all these there was no recurrence (dead tumors). Recurrence was very quick whenever cultures were very successful.

Inoculations with virulent cultures produced in a bitch two encapsulated lipomata, in guinea-pigs cellular growths in the mammæ and cylindrical epithelial growths in the liver. In testicles the microbes were destroyed by phagocytes. The phagocytosis is worthy of study.

The pathogenesis of human tumors appears to consist in an irritation of the normal body elements, which by means of division and increase carry on a fight against the inroads of the micrococcus neoformans.

If the phagocytic power of the proliferating cells prevails,

the tumor ceases to grow, but microbes can remain latent in it. Under such circumstances, an originally benign tumor may become malignant. If the tumor has assumed malignant characteristics, the primary focus may remain absolutely or relatively sterile, the secondary nodules being virulent. Sarcomata remain stationary longer than epitheliomata because of the greater vitality of the mesoderm cells. This also explains the more rapid infection of the lymphatics in cancer than in sarcoma.

Injections of the toxins of micrococcus neoformans, modified by treatment with hydrochlorate of quinine and kakodyl, give a noticeable reaction and, in not too severe cases, do good.

In severe cases it is necessary to follow the treatment proper by the injection of a different fluid of special activity, which after a time gives rise to marked changes in the neoplasm. If the action of this second fluid is too strong, an antitoxin is injected.

Albert Robin, Roux, Metschnikoff, and Labadie-Lagram have superintended the treatment in several inoperable cases. Several tumors are now in the stage of resorption, without necrosis, the tumor tissue being gradually replaced by healthy.

The author concludes, "I will only remark that I have succeeded in obtaining, in more than 400 cases, from pieces of tumor pure cultures of a microbe which is pathogenic in animals, and that, based on this, I have instituted a new method of treatment which has proven superior to previous means in cases of inoperable disease."—*Verhandlungen der deutschen Gesellschaft für Chirurgie*, 1902.

III. Intramuscular Bone Formation after Trauma. By DR. VULPIUS (Heidelberg). Bone may be formed in muscle after repeated trauma or after a single injury. The latter may be due to development from a dislocated portion of periosteum (Berndt) or to true intramuscular bone formation. The author reports a case of this purely intramuscular development.

Workman, aged twenty-one years, fell, hitting his thigh. After three weeks unable to work. Progressive stiffness of knee.

After ten weeks, removal by operation of a hard, freely mobile tumor lying in the quadriceps. The specimen proved to be a bone cyst, entirely intramuscular in location. It was covered by a glistening membrane, which sent prolongations as septa into the lumen. Contents were blood-stained serum. The periosteum of the femur was intact. Around the cyst there were a few scattered callosities in the connective tissue, with partially ossified foci.

Such cysts of traumatic origin have been very rarely described (two cases). The most evident explanation of their etiology is that a new formation of bone is excited in the connective tissue surrounding the extravasated blood. Why the connective tissue should be excited by the trauma to form bone is as obscure as the cause of the analogous progressive ossifying myositis.—*Verhandlungen der deutschen Gesellschaft für Chirurgie*, 1902.

IV. The Transplantation of Dead Bone into Indifferent Soft Parts, alone or in Connection with Living Periosteum. By DR. SULTAN (Königsberg i/Pr.) The following results are grounded on experiments on dogs. When a piece of fresh bone without periosteum is implanted in muscle, the bone-cells die and the bone is absorbed. Portions of the medullary bone may remain alive and form new bone, but this new formation is so slight as to be out of all proportion to the resorption.

When a portion of bone covered by periosteum is implanted in muscle, there is also a death of bone-cells, but the periosteum remains lively and forms new bone to replace the dead.

If portions of bone, killed by boiling, are wrapped up in pedunculated flaps of periosteum (the dead bone being in contact with the osteal surface of the periosteum), the periosteum proceeds to form new bone with rapidity. The new bone penetrates the dead and seems to increase at its cost.

The chances of new bone formation after the transplantation of non-pedunculated, *i.e.*, free portions of periosteum, are in-

creased if the membrane is folded or rolled up with its osteogenetic layer inside.—*Verhandlungen der deutschen Gesellschaft für Chirurgie*, 1902.

V. Nature's Means of Obtunding Pain. By Dr. Ritter (Greifswald). It is generally supposed that pain in inflammation is due to pressure by exudates exerted on the nerves. This explanation does not agree with a number of facts. Hot baths, hot sand, and hot air relieve pain enormously in many chronic inflammations, and yet, according to Bier, they act by exciting a high grade of arterial hyperæmia. The artificial hyperæmia produced in Bier's treatment of various chronic inflammations increases pressure, but relieves pain. The same relief of pain was observed by Ritter in treating a case of frost-bite by artificial hyperæmia. Schleich's method of local anæsthesia by infiltration increases pressure.

Ritter, after examination of the power of perceiving pain in the most varied forms of inflammation, finds that in all acute inflammations the perceptive power increases quickly, but that as soon as serous infiltration (œdema) appears in the tissues, it markedly diminishes. These observations were made not merely in cases of various infective inflammations, but also of traumatism. Even in inflammation of the skin (*e.g.*, erysipelas) there is at first increased perception of pain, but later, when the tissues are tensely infiltrated, the pain perception is lowered.

Ritter carried out a series of experiments on himself, producing artificial hyperæmia and inflammation. He found that hyperæmia, whether produced by bandages or by cupping, always diminished the perception of pain, while inflammatory arterial hyperæmia increased it to begin with, but that as soon as exudation was established the power of perception of pain always became lower than normal. Schleich bases his method of producing local anæsthesia on the fact that non-inflammatory œdema lowers the sensibility of the tissues. Inflammatory œdema is

comparable to the wheals produced by the Schleich injections, which *immediately* occasion pain, later, anæsthesia.

Braun believes that the anæsthetic effect of Schleich's injections depends on the osmotic tension of the fluid used. May this not be the explanation of the phenomena observed in inflammatory infiltration?

By determination of the freezing point of fluids obtained from inflammatory swellings, Ritter found a distinct increase of the osmotic pressure compared to that of the normal tissue fluids.

v. Koranyi has shown that normally the concentration of the tissue juices varies according to the destruction of albumen in metabolism, and Ritter points out that in the various forms of inflammation, etc., there is an increased destruction of albumen (necrosis of tissue). In all probability, then, it is due to increased destruction of albumen that the juices in inflammatory exudates are of a high tonicity.

The conclusion is evident that the pain in inflammation is not due to the pressure of exudates, but to their increased concentration. Anæsthesia rapidly follows the early pain. This anæsthesia is not desirable, as it is often a source of danger to the tissues, as a complete anæsthesia is equal to death of the affected cells. However, v. Koranyi has shown that the body does not submit passively to the increased concentration of the inflammatory fluids, but endeavors to prevent or dilute them. This dilution is attained by osmosis, the blood and serum flowing towards the fluid of high osmotic tension.

Ritter has observed, contrary to former investigators, that every chemical injected into the skin produces a hyperæmia in the neighborhood. The stronger the concentration of the chemical, the greater the hyperæmia or serous infiltration. When isotonous fluids are used, the hyperæmia is least, when serum is injected, it is almost absent. The influence of this hyperæmia on the sense of pain is proved by the injection of normal salt

solution, which neither produces hyperæmia, pain, nor anæsthesia.

From this investigation, it follows that one must consider hyperæmia (whether arterial or venous) and serous infiltration Nature's means of alleviating pain by lowering the injuriously high concentration. Normally, this method of alleviating pain acts very promptly, but in severe injuries and in the anæmic it is often delayed. Under such circumstances one may artificially produce or increase it (1) by all so-called counterirritants (according to Ritter it is impossible to produce an inflammatory hyperæmia without injuring the tissues); (2) the most effective and least injurious means is that suggested by Bier, viz., artificial stasis, cupping, Junod's boot, and hot air.—*Verhandlungen der deutschen Gesellschaft für Chirurgie*, 1902.

JOHN F. BINNIE (Kansas City).

REVIEWS OF BOOKS.

SURGICAL EXPERIENCES IN SOUTH AFRICA, 1899, 1900, being mainly a Clinical Study of the Nature and Effects of Injuries produced by Bullets of Small Caliber. By GEORGE HENRY MAKINS, F.R.C.S., Surgeon to St. Thomas's Hospital, London, etc. Illustrated. 8vo, pp. 493. Philadelphia: P. Blakiston & Co., 1901.

It is probable that, since the days of Æsculapius himself, the periodic struggles for supremacy between individuals and between nations have led some of our medical brethren to study cause and effect as these relate to war and its results. It is certain that since the campaigns of the great Napoleon were made the subject of exhaustive medical study by his famous surgeon, Larrey, each great war has been the means of disseminating much knowledge concerning wounds and their consequences. The Napoleonic campaigns, the Crimean War, the Franco-Prussian struggle in Europe, and the titanic combat between the North and the South in our own land, each in turn has given an impulse to medical literature. Indeed, the medical and surgical history of the War of the Rebellion is, without exception, the most extensive and comprehensive single contribution to this field of thought that the world has ever seen.

Human passions and human sufferings appear to be unchanged by the slow passage of time, but the implements of wrath change with each new generation. Slings and arrows, sword and lance, stone cannon-balls and smooth-bore muskets, each has had its day of pre-eminence, and each in turn has been replaced by some deadlier weapon. The twentieth century finds military surgeons studying the effects of lydite shells and small caliber projec-

tiles from rapid-firing rifles that have doubled the radius of the zone of death within a single generation. And these are the guns and missiles that have cost thousands of dead, tens of thousands of wounded, and hundreds of millions of dollars to one side alone of the combatants in South Africa in the war now happily ended.

From this mass of human documents thus offered for study, one of the surgeons of the campaign has collected statistics concerning the cases which came under his personal observation, and has published them in a readable book entitled "Surgical Experiences in South Africa."

The volume is best considered in three general sections.

The first of these is devoted to a description of the surgical outfit taken, the manner of its conveyance, the way in which the medical staff was subdivided and assigned to enable field and base hospitals to be properly manned, the transport of the wounded, and an interesting comparison of the merits and defects of hospital corps and medical equipments coming from different parts of a world-wide empire.

Modern military rifles, their projectiles and their efficiency, is the essential subject of the second portion of the book. The Lee-Metford, the Martini-Henry, the Guedes, the Mauser, and the Krag-Jörgensen rifles were the weapons used by both parties in the war, and the caliber, the weight, the shape of the ball, the character and thickness of the mantle, the velocity, the range, and the trajectory were all important factors in the injuries which occurred.

In the second chapter the general character of the wounds produced by bullets of small caliber are considered, and the camera and skiagraph apparatus have both been freely employed to show the appearance of the external wounds and the underlying injuries to bones in the path of the missile.

These two sections serve as an introduction to the more strictly surgical portion of the book which follows, and which is really the most important part of the volume. The injuries to

the blood-vessels, the limbs, the joints, the head and neck, the vertebral column and spinal cord, the peripheral nerves, the chest, and the abdomen are grouped together in their respective classes, and each is made the subject of a chapter describing the injuries in general, and giving concrete case histories of the more important or unusual complications.

The injuries to the chest and to the abdomen were of especial interest, for here it was expected that opportunities for observing new conditions and for probable advance in active surgical treatment would be best observed. The disappointment, therefore, was greater, for "wounds of the solid viscera, it is true, proved to be of minor importance when produced by bullets of small caliber; but wounds of the intestinal tract, although they showed themselves capable of spontaneous recovery in a certain proportion of cases observed, afforded but slight opportunity for surgical skill, and the results generally deviated but slightly from those of past experience. Such success as was met with depended rather on the mechanical genesis and nature of the wounds than upon the efforts of the surgeon, and operative surgery scored but few successes." These chapters are, however, of great interest to the civil surgeon, and the book, as a whole, will be of great value to all surgeons, because, with the increase of the use of small caliber, high-power guns for target and for hunting purposes, gunshot wounds may come under the observation of any one, and familiarity with the details of such a number of widely varying cases as those described by Dr. Makins will add materially to the mental armamentarium of any operator.

HENRY P. DE FOREST.

THE ACCESSORY SINUSES OF THE NOSE: Their Surgical Anatomy and the Diagnosis and Treatment of their Inflammatory Affections. By A. LOGAN TURNER, M.D. Edinburgh: Wm. Green & Sons.

The author first deals with the anatomy of the accessory sinuses, laying particular stress upon such points as have a sur-

gical bearing. The first five chapters are devoted to this subject, the average form and size of the sinuses being arrived at by comparative measurements, departures from the average are noted, and particulars are given of the extensions of the sinuses in various directions.

Chapter vi is a long one, and is devoted to rather lengthy details of the examination of a large number of skulls of different races, with a view to studying the comparative anatomy of the frontal sinuses in the various races of man, by means of transillumination, verified where necessary by borings. An investigation is also made with a view to ascertaining whether any relationship exists between the height and breadth of the frontal sinus and the height and breadth of the skull.

Chapter vii deals with the diagnosis of pyogenic conditions of the antra by means of transillumination. With regard to the diagnosis of frontal sinus conditions, the result, as was already indicated to some extent by the examinations recorded in Chapter vi, is unsatisfactory, while the utility of the method, with regard to maxillary sinus conditions, is upheld.

The remaining three chapters deal with the etiology and pathology, diagnosis and treatment of suppuration in the sinuses.

The description of the anatomy of the sinuses is clear and readable, and gives evidence of careful study of the subject, while the text is profusely illustrated by well executed plates.

The chapter on the comparative anatomy of the frontal sinus in the various races of man, and the investigation into the relationship between the form of the frontal sinus and the type of skull, is an interesting one, and is dealt with in a thorough and masterly manner. The plates illustrating this chapter are likewise numerous and good.

These chapters would of themselves render the book, which is well gotten up and clearly printed, worthy of perusal and careful study.

JOHN A. C. MACEWEN.

FATAL ACETONÆMIA FOLLOWING AN OPERATION FOR ACUTE APPENDICITIS.[1]

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THE object of this communication is to report and place on record the history of a case of acute perforative appendicitis, which was apparently progressing favorably after operation, in which death probably resulted from an acute autointoxication of the type seen frequently in diabetics and described under the term acetonæmia. The condition is in the writer's experience absolutely unique, and he has been unable thus far to find any record in literature of its occurrence as a fatal surgical complication in non-diabetic cases.

S. S., aged twelve years, a school-boy, was admitted to the Roosevelt Hospital on April 29, 1901. There was nothing in the family history nor in the previous history of the patient which could have any bearing upon the pathological condition which is to be described. Previous to this illness he presented every evidence of the most robust health.

Two days before his admission, after a long and rather fatiguing military drill at his school, he was suddenly seized with an acute abdominal pain, which was more or less general at first, and was accompanied by nausea and vomiting. Later the pain became more severe, and was referred to the right inguinal region. There was a slight elevation of temperature and an increase in the pulse-rate. He was seen by Dr. Edson, his family physician, early in the evening, and on examination he found tenderness

[1] Read before the American Surgical Association at Albany, New York, June 3, 1902.

and muscular rigidity in the right lower quadrant of the abdomen. Appropriate treatment was prescribed, including an ice-bag to the inguinal region. The following day there was a very considerable improvement in all the symptoms; the temperature had fallen to 99.8° F., pulse to 90, and there was no pain.

He passed a comfortable day, but during the following night the pain returned, and on the morning of his admission to the hospital, as the temperature was 101° F., pulse 110, leucocytes 17,000, an immediate operation was advised. After the usual preparation, under chloroform anæsthesia, an incision was made over the region of the appendix and the abdominal cavity opened by the intermuscular method. Examination revealed the presence of a tumor composed of intestine, omentum, and the inflamed appendix glued together with plastic exudate, and situated in the iliac fossa near the anterior superior spinous process. After walling off the intestines with gauze pads, the adhesions were separated, and a perforated gangrenous appendix found in a small abscess cavity which contained about two drachms of foul-smelling pus. The appendix was removed, the cavity disinfected, two cigarette drains introduced, and the wound partly closed.

Duration of anæsthesia about twenty-five minutes.

After his return to his room, the temperature was found to be 103° F., pulse 120, and of good quality. As his general condition at that time seemed satisfactory, no stimulation was ordered. Considerable pain followed his recovery from the anæsthetic, which was relieved by one-eighth grain of morphine. There was no vomiting, and he was able to take and retain water by the mouth four hours after the operation. During the night he became restless and complained of more pain, but was again quieted by a small dose of codeine. The following morning he seemed bright, the temperature had fallen to 101° F. and the pulse to 88; he took and retained fluid food; later in the day there was a still further drop in the temperature. He complained of some distention; an enema was given, which resulted in a fairly large yellow movement.

The second night after operation was a comfortable one; his distention was relieved, gas passed freely by the rectum, and he slept about six hours. The following morning his temperature had fallen to normal, his pulse to 76; he seemed cheerful and happy and expressed himself as free from pain and hungry.

The wound was dressed, and was found to be in a satisfactory condition. The abdomen was flat; there was no rigidity, and only slight tenderness in the wound area. Calomel and salts were administered; the bowels moved again, and much gas was expelled.

During the entire day his temperature remained normal and his pulse never rose above 80. He slept most of the afternoon and made no complaint. The urine, which before operation had been normal, to-day showed a slight trace of albumen and a few finely granular and hyaline casts; no sugar, pus, or blood.

The following night he slept quietly until shortly after midnight, when he suddenly awakened and, without any apparent cause, uttered a piercing shriek, which was so agonizing and expressive of terror that it not only greatly alarmed his nurse, but also his mother, who was sleeping in an adjoining room. He continued to scream for several seconds, looked wildly about, and apparently failed to recognize those around him. A few moments later he again fell asleep and rested quietly until the morning. The symptoms were at first attributed to a bad dream or nightmare. The following morning he was distinctly somnolent, and when aroused would cry out and appear for a moment very much frightened, but would be easily soothed by his mother, after which he would again fall into a quiet sleep. His temperature was 98.5° F., pulse 74; the abdomen was soft; there was no distention; the secretion of urine was free and of the same character as on the preceding day. He was seen by the writer at about eleven o'clock in the morning. He was then sleeping soundly, and appeared in every way normal. On waking him, he again uttered an agonizing cry and looked the picture of abject terror. His eyes wandered from one person to another without the slightest sign of recognition. He continued to scream with such vehemence that his cries were heard all over the building. All efforts to soothe him seemed unavailing; his terror was painful to witness, and the whole picture suggested unspeakable fright and the most acute mental suffering. These paroxysms would last from a few seconds to two or three minutes, and would be succeeded by a comparatively long interval of rest, during which he would apparently be sleeping quietly.

The pupils were symmetrical and reacted to light and accommodation. There was no evidence of cranial nerve palsy or

irritation. There was no impairment of sensation or motion in any part of the body; the reflexes were apparently unaffected. His temperature and pulse remained normal, and there was nothing to indicate any gastro-intestinal irritation, pulmonary or cardiac disturbance. I immediately called my colleague, Dr. Blake, in consultation, and, after a thorough examination, he agreed with me that the wound conditions were satisfactory, and that there was no evidence of sepsis. He was unable, however, to offer any explanation of the mental symptoms, and we both agreed that the opinion of an expert neurologist should be obtained as soon as possible. As the parents urged us to call upon any one who could be of service to us, a consultation was quickly called, at which Dr. Edson, the family physician, Dr. Blake, Dr. Pearce Bailey, and Dr. George L. Peabody were present. After carefully reviewing the history of the case from the beginning, and repeating the previous examinations, during which the child passed through several of the screaming paroxysms, the consensus of opinion as expressed was that the patient presented evidences of extreme cerebral irritation, the cause or causes of which could not at that time be discovered, as none of the gentlemen present had ever seen or heard of a similar case.

During or shortly after the consultation the writer noticed a peculiar sweetish, ethereal odor of the breath, which was verified by each one present. The nurse stated, in answer to inquiries, that she had noticed that peculiar odor ever since she came on duty at seven o'clock in the morning. The opinion was expressed that the odor was in all probability that of acetone, and indicated a condition of acetonæmia which might be a causative factor in the production of the symptoms. As none of those present at the consultation had ever observed symptoms due to acetonæmia in conditions other than diabetes, and as the symptoms of acetonæmia in diabetes were usually those of a rapidly deepening coma, rather than delirium and cerebral irritability, no definite conclusions could be arrived at until more complete examination of the urine or blood could be made, and further observations of the symptoms and progress of the case. Meanwhile the symptoms were increasing in severity, the paroxysms occurring more frequently, the character of the delirium becoming more distressing, and the intervening sleep deeper and more resembling coma. At 6 P.M. the temperature was still normal; the pulse during sleep 80, but

weaker; physical signs unchanged. An hour later the patient was seen in consultation by Dr. Evan Evans, who expressed very positively the belief that the symptoms were due to an acute auto-intoxication which is associated with the presence of acetone and diacetic acid in the blood. He gave an extremely grave prognosis, predicting death within twenty-four hours unless the symptoms were speedily relieved by free catharsis, diuresis, and the intravenous injection of a solution of chemically pure bicarbonate of sodium. He volunteered to make a thorough analysis of the urine and blood, which he did immediately at the pathological laboratory of the College of Physicians and Surgeons.

The result of this analysis showed large quantities of both acetone and diacetic acid in the urine and blood.

The subsequent history of the case is as follows:

At 8 P.M. about 400 cubic centimetres of blood were withdrawn from the median cephalic vein of the left arm and sent to the laboratory for examination, after which he was given an infusion of about 1000 cubic centimetres of normal salt solution, to the last of which about fifteen grammes of chemically pure bicarbonate of sodium were added. The stomach was next washed and a large dose of calomel and Epsom salts introduced through the tube. After an hour's rest he was given a prolonged hot saline irrigation of the rectum by means of a Kemp's tube. An hour later another dose of Epsom salts was administered with a stomach-tube, followed by a high enema of turpentine, glycerin, and soap-suds. As there had been no spontaneous urination for several hours, he was catheterized, and a moderate quantity of urine withdrawn having a very strong odor of acetone.

During this time the character of the symptoms underwent a change. The paroxysms of screaming were of shorter duration, and occurred less frequently; the intervening sleep was more profound, and he was less easily awakened by treatment; the pupils seemed more dilated; there was no change in the temperature, although the pulse increased somewhat in frequency and was evidently growing weaker. The circulation in the extremities was slower; the face seemed slightly cyanosed; the eyes expressionless. Shortly after midnight, as the bowels had not moved, and as it was thought that the intra-abdominal cigarette drains might be causing mechanical obstruction, the wound was dressed and the drains removed. It was then observed that the abdomen

was somewhat distended. An hour later, as his condition seemed unchanged, he was given two ounces of castor oil and two minims of croton oil through the stomach-tube, and the hot saline rectal irrigation repeated. About 3 A.M., as no movement had occurred, he was given another high enema of turpentine and glycerin without result.

Between four and five his condition began to change for the worse; the respiration became shallow and more rapid, the pulse was weaker, and the temperature rose rapidly to 103° F.; the paroxysms of acute delirium ceased, and he fell into a condition of progressively deepening coma. As there had been no movement from the bowels, as a last resort, early in the morning the cæcum was opened in the wound and the bowel freely irrigated, but without producing any change in the symptoms, which steadily progressed until eleven in the morning, when he died.

In the absence of an autopsy, which, under the circumstances, it was impossible to obtain, the only method of correctly interpreting these extraordinary symptoms and arriving at a correct diagnosis is by the method of exclusion. Briefly stated, we have to do in this case with a localized septic focus in the abdominal cavity, well protected by nature, and thoroughly removed by operation. Following its removal, there was a rapid subsidence of all septic manifestation, evidenced by a progressive fall to the normal of the pulse and temperature, the disappearance of all pain, rigidity, and distention, free evacuation of the bowels, and a general and progressive improvement in the patient's appearance, behavior, and feelings. In the midst of this improvement, and unaccompanied by any evidence of either local or general sepsis, there suddenly occurred acute delirium, frightful hallucinations, a failure to appreciate his surroundings or recognize those about him, somnolence, coma, and death within thirty-two hours from the first untoward symptom.

The irritant which produced this extraordinary and rapidly fatal cerebral disturbance must have been a very powerful one, or one which was developed in large quantities during a very short period of time. Of the various causes which might

give rise to such a train of symptoms, we must consider, first, traumatism; second, septic infection, local or general; third, the toxic action of drugs, and, fourth, autointoxication.

Traumatism can be absolutely excluded by the history. Of the septic processes which might act as a causative agent, we must consider acute meningitis or cerebritis, from middle ear suppuration, frontal sinus, or ethmoidal disease; epidemic cerebrospinal meningitis; or a metastatic process from the abdominal focus. The first three can be absolutely excluded by the history and result of local examinations, as well as by the fact of the acuteness of the onset, rapidity of progress, and early termination. These facts, together with the complete absence of fever or general illness, would serve also to exclude epidemic cerebrospinal meningitis. Septic meningitis, in the writer's opinion, can be absolutely excluded by the absence of prodromal headache, restlessness, intolerance of light and sound, from the extremely sudden development of the gravest mental disturbances without the slightest premonitory sign, from the absence of fever and the presence throughout of a slow, calm, even pulse, which remained at a point generally below 80 until a few hours before his death.

It is impossible to conceive of a septic meningitis of such virulence, that it ran its course from the first sign to a fatal coma in thirty-two hours, to exist without fever. Moreover, a metastasis of such virulence would not be likely to occur after the complete removal of the original focus and after three days of rapid improvement in all the symptoms. That we may have structural changes in the meninges accompanied by exudate, as in the other serous membranes of the body, due wholly to an intense toxæmia from some remote septic focus, will not be questioned. In fact, one of the consultants suggested this as a possible explanation of the symptom in this case. The writer believes, however, that this can be excluded, from the fact that the symptoms did not appear during the stage of the disease when the toxæmia was necessarily greatest, before the removal of the septic focus, but did appear after

the disappearance of all indications of toxæmia, as evidenced by a disappearance of the local inflammatory conditions, and a return to the normal of the temperature and pulse. Moreover, one would not expect a toxæmia of that virulence to manifest itself by cerebral symptoms alone, with a complete absence of the other ordinary indications of such a condition.

The toxic action of drugs can be positively excluded in this case, as only one-eighth of a grain of morphine, a very small amount of codeine, Epsom salts, and calomel had been administered.

Of the auto-intoxications, three varieties must be considered,—ptomaine poisoning, uræmia, and acetonæmia.

In ptomaine poisoning the symptoms are due to the local and general effect of toxic substances which are generated in the gastro-intestinal tract by various fermentative and putrefactive processes. The symptoms are similar to those produced by some powerful and poisonous alkaloid. There is acute prostration with rapid, feeble pulse; cold perspiration and subnormal temperature, accompanied often by severe vomiting and purging. The symptoms appear suddenly, the progress of the disease is rapid, in the fatal cases death occurring often in a few hours. The absence of any symptoms of prostration or gastro-intestinal irritation, and the fact that the diet had been limited to milk, broths, and rice would serve to exclude this disease.

Uræmia can be excluded by the absence of any evidence of previous disease of the kidneys, and by the fact that up to within a few hours of death a full amount of urine was secreted containing a normal output of solids. Moreover, there was nothing whatever in the clinical picture to suggest uræmia.

If we are justified in excluding the above conditions, it is the writer's opinion that we must assume that the cause of death in this instance was the occurrence of that form of auto-intoxication described as acetonæmia.

That the term acetonæmia is a misleading one will be

evident from the following brief *résumé* of the facts bearing upon our present knowledge of this condition.

Acetone is a colorless, limpid fluid, of a sweetish, ethereal odor, and has been known chemically for many years.

It was first discovered as a pathological constituent of the urine by Pettus in 1857, who observed it in a case of diabetic coma. Kaulich afterwards found it constantly present in varying quantities in all stages of the disease. Kussmaul in 1874 described the symptoms of diabetic coma, but threw some doubt on the toxic action of acetone as a causative factor; and, later, Gerhardt and others demonstrated the constant association of diacetic acid and B. oxybutyric acid with acetone in the blood and urine. Without going further into the history of the subject, it may be stated that, under certain conditions of the body metabolism, the most important of which, according to Herter, is an increased destruction of proteid matter, acetone appears in variable quantities in the blood and urine, and if present in large amount is associated with the presence of diacetic and B. oxybutyric acids, and possibly some other volatile fatty acids. This is the condition usually spoken of as acetonæmia, but it is better described by the term "acid intoxication," or excessive "acidosis."

This condition is often associated with grave cerebral disturbances, of which delirium and coma are prominent symptoms, and, if the intoxication is of greater intensity, death speedily results. At first the toxic agent was thought to be the acetone, but this was afterwards proved by animal experiments to be harmless. Later, the diacetic and B. oxybutyric acids were held responsible for the symptoms; but later investigation has shown that the symptoms, to a large extent at least, depend upon an entirely different cause.

It has been recently demonstrated that the presence of these three substances in the blood results in a marked diminution in its normal alkalinity, upon which depends its ability to absorb carbon dioxide from the tissues, and that the symptom complex in this condition is due rather to a rapid carbon dioxide poisoning of the tissues than to the toxic effect of any

or all of these substances, although it is held by some authorities that the oxybutyric acid and the probably associated volatile fatty acids are in themselves to some extent toxic.

The three characteristic symptoms of this condition are, a well-marked sweetish, ethereal odor of the breath, delirium, and a rapidly fatal coma. In the great majority of instances the stage of cerebral excitation is brief and often overlooked, the only symptom appearing to be a progressingly deepening coma.

Other symptoms are occasionally observed, among which may be mentioned the "air hunger" described by Kussmaul, and evidenced by increased rapidity and depth of respirations, with a bright red color of the mucous membranes and the skin, due to the presence of aërated blood in the veins from the inability to absorb carbon dioxide from the tissues. R. T. Williamson, in the "Encyclopædia Medica," describes an alcoholic type in which the stage of cerebral excitation is most marked, the patients becoming wildly delirious, and exhibiting evidences of fright strongly resembling delirium tremens. This type of this disease is perhaps more common in children, and has been described in the *Traité des Maladies de l'Enfants* by Graucher, Comby, and Marfan in the following manner: "In other cases the child is seized by violent agitation, with groaning and unintelligible cries, incoördinate movements, and delirium, the coma manifesting itself only after the period of excitation has passed. The temperature is often subnormal."

Regarding the odor of the breath, the writer continues: "Many cases are signalized by a peculiar odor of the breath; a pungent or vionaceous odor or the odor of acetone itself, sometimes comparable to that of a pippin apple, sometimes to that of chloroform. It may be quite faint, appreciable only on leaning over the bed near the patient's mouth, or very marked, filling the whole room."

While this condition of acid intoxication was formerly thought to occur to a fatal degree only in diabetes, a sufficient number of cases have been reported to conclusively demon-

strate that it can occur independently of that disease. Clinical and experimental researches have shown that it may occur in infectious fevers and general sepsis; in intestinal fermentation and putrefaction; in pregnancy with the presence of a dead fœtus, in brain lesions, in tabes, paresis, and melancholia, as a result of general anæsthesia from both ether and chloroform; after extirpation of the pancreas in animals; and under conditions of a changed diet, especially the complete elimination of carbohydrates from the food, and in starvation.

Seeking to establish the cause or causes of death in the so-called cases of "chronic chloroform intoxication" described by Casper, König, Volkmann, and others, Kast and Mester (*Zeitschrift für klinische Medicin*, Band xviii, p. 469), in 1891 undertook a series of observations upon the urine of patients, after anæsthesia by chloroform, and found, among other substances indicating increased destruction of proteid matter, a condition of hyperacidity, the cause of which was not at that time determined. Later, Ernst Becker (*Deutsche medicinische Wochenschrift*, 1894, Band xviii, p. 469, *Virchow's Archives*, Vol. cxl, p. 1), after observation of a large number of cases in which general anæsthesia was immediately followed by symptoms of acute acetonæmia in diabetes, systematically examined the urine of several hundred healthy individuals, before and after the administration of the various anæsthetics, with the result that in over sixty per cent. of his cases general anæsthesia was followed by a pathological amount of acetone in the urine; that the highest percentage occurred after chloroform narcosis, and that it was more frequently observed in children than adults. He reports one case in which the classical symptoms of acidosis, hallucinations, cries, stupor, coma, air hunger, cold extremities, Cheyne-Stokes respiration, etc., followed general anæsthesia, associated with marked acetonuria. The symptoms were alarming and lasted nineteen hours. The life of the patient was saved only by the persistent employment of artificial respiration and active stimulation. The urine was free from acetone before the anæsthetic, and at no time contained albumen or sugar.

In a series of observations undertaken at the Roosevelt Hospital by Dr. J. H. Blue, at the suggestion of the writer, the presence in the urine of a pathological amount of acetone occurred in seven out of thirty-three cases following anæsthesia. In five of these chloroform had been used, and in two ether. None of the cases were diabetic, and in none was there a reaction for acetone before the administration of the anæsthetic. In all the acetone appeared on the day following the operation. In two it was found on the second and third days, in the remaining five on the second. In six of the cases there were no symptoms which could be attributed to acidosis; in the seventh death occurred thirty-six hours after a gastro-enterostomy for carcinoma, with rather indefinite symptoms of so-called secondary shock.

While these observations by no means establish the fact that a condition of true acid intoxication was present in seven of our thirty-three cases, as there was no proof that the urine contained either diacetic or B. oxybutyric acid, they show at least that there was in these cases an increased destruction of proteid matter, a condition which may be regarded as the first step in a pathological process which, if continued, would probably lead to a condition of acidosis sufficient to give rise to symptoms.

I think most surgeons have had the experience of seeing certain patients die on the second or third day after comparatively simple operations, exhibiting indefinite toxæmic symptoms which occur rather too early to be attributed to sepsis and rather too late to be accounted for by shock—a condition which is often described by the indefinite and meaningless phrase "secondary shock." It may be that later investigation will show this condition of acid intoxication to be a factor in some of these cases.

In conclusion, the writer desires to say that it is his intention to continue these investigations, and if any facts are obtained bearing upon surgical acetonæmia which are worthy of record, to present them at a subsequent meeting of the

Association. This communication he hopes will simply be regarded as a preliminary report.

ADDENDUM.

Test for Acetone.—Place about twenty cubic centimetres of the urine in a small glass retort, heat over an alcohol flame, and condense vapor in a cold test-tube; then add small amount of potassium hydrate to render reaction alkaline, after which add four or five drops of Gram's solution of iodopotassic iodide, and heat gently. If acetone is present, a strong iodoform odor will be produced, and yellow crystals will form in the tube.

Test for Diacetic Acid.—Fifteen cubic centimetres of urine should be treated with a dilute solution of ferric chloride (not too acid) as long as a precipitate forms. This should be removed by filtration, and the filtrate again treated with the ferric chloride. A claret-red color indicates the presence of diacetic acid. To verify this, a second fifteen cubic centimetres of urine should be boiled and tested in the same manner. This should give a negative result, as the diacetic acid is decomposed by boiling.

Test for B. oxybutyric Acid.—This requires the resources of a well-equipped laboratory. In the presence of acetone and diacetic acid, the presence also of B. oxybutyric acid may be assumed if the polariscope shows a strong rotation to the left of the plane of polarized light, in the absence of levulose and the glycuronates.

ACUTE SUPPURATIVE PANCREATITIS.

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From the interest and increasing attention devoted during the past few years to the subject of pancreatitis many practical and important facts have been added to our knowledge of the disease, particularly as regards its etiology and pathology.

The principal and direct cause of the infection is the entry of bacteria into the gland, and the usual route is from the duodenum by the way of the pancreatic duct. It is an ascending infection due, secondarily, to lesions in the duodenum, and the acuteness of the resulting inflammation depends rather on the degree of infection and not on the nature of the exciting agent. Thus the most acute infection when established is followed by the acute hæmorrhagic form, the less acute provokes suppuration or gangrene, while the still less active agent causes sclerosis of the pancreas. Clinically, the most rapid and fatal form is the acute hæmorrhagic; the gangrenous and suppurative forms are less so, while the least dangerous is the chronic interstitial form. Hæmorrhage, suppuration, necrosis, and sclerosis are closely related to each other, are due to a common cause, and mostly represent a varying degree of infection.

A mild catarrhal inflammation of the duct may exist to start with, and continue for some time; later on, owing to some determining cause, as gall-stone, pancreatic calculus, abuse of alcohol, etc., the inflammation assumes an acute form and hæmorrhage, suppuration, or gangrene of the gland suddenly follows.

The treatment is that of a septic infection. Its indications

are strictly surgical, and by surgery alone may we hope for success in these otherwise hopeless cases. In the acute cases, incision, removal of the septic foci, and packing, together with free drainage, is called for; in subacute cases incision and drainage of the abscess are indicated; and in the chronic form —which has been shown to be frequently associated with gall-stone—through cholecystotomy the pancreatic ducts are indirectly drained and the inflammation subsides.

In meeting these indications, we are as yet handicapped by our exceedingly limited ability of diagnosis, and we still await the discovery of symptoms characteristic of the disease. As acute pancreatitis is more frequent than formerly supposed, and, as in acute cases a fairly definite clinical picture has been depicted, these facts should lead us to recognize the disease more frequently .

The possibility of making a correct diagnosis has been demonstrated in some instances; and it is the object of this brief paper to record a case in which the diagnosis was made before operation, and the treatment was followed by success.

O. F., forty-one years of age, salesman, was admitted, May 8, 1901, to the New York Hospital. He had been a steady consumer of alcohol for twenty years, and for the past seven years has been a heavy drinker. About every six months has been accustomed to going on sprees lasting anywhere from three to six weeks, and with the exception of these periods has always enjoyed excellent health. Five years ago, after a spree, he had an attack of severe epigastric pain accompanied with bilious vomiting, the attack lasting three days, and was relieved by medication. Three years ago, after a debauch, he had a similar attack, which yielded to medical treatment. Last January, after a spree lasting two weeks, he was again seized with sudden epigastric pain accompanied with bilious vomiting; the attack lasting this time about a week; but he was unable to return to work for about three weeks. In this attack the pain was more severe, and radiated to the left side and under the left shoulder. About the middle of April another debauch followed, lasting about two weeks, and eight days previous to admission he was suddenly seized with

epigastric pain and vomiting. The vomiting was frequent, of a bilious character, and was increased by the ingestion of food or drink, and after a week's duration it subsided. The pain was, however, more severe than in the previous attacks and limited to the epigastric region, radiating at times laterally, but it steadily increased, and finally extended over the entire abdomen. Two days before admission he noticed that the belly was swollen below the ribs and that his clothes were too small for him. No history of chills or fever; bowels constipated.

Owing to the failure of the treatment, which had been successful in the previous attacks, he applied for admission to the hospital.

The patient was a man of medium height and very fat, with a decided septic appearance. His tongue was coated with dark brownish fur; no jaundice. Heart and lungs negative. Abdomen distended, with marked prominence in the left epigastric region. General abdominal tenderness on palpation, most marked in left epigastrium, where belly wall is somewhat rigid. In this region is a mass about the size of a cocoanut, sharply defined, tense, and tender on pressure. It is situated chiefly above and to the left of the umbilicus, and extends a short distance to the right of the median line. It is dull on percussion; above and over the region of the stomach light percussion gives a tympanitic note; below the mass, percussion is tympanitic also. The tumor apparently lies between the stomach and transverse colon. Deep percussion over the stomach is dull; the dulness extends into the left hypogastrium, and downward is continuous with that over the tumor. Owing to the fat belly wall no tumor could be felt behind the stomach, but there was a well-marked sense of resistance. Liver dulness small; free edge not to be felt. Skin over back and on the side of the abdomen red and blistered in spots from mustard paste applied before admission. Temperature, 101.8° F.; pulse, 100, and weak; respiration, 36. Urine, clear, acid, 1031, no sugar or albumen. Leucocytosis, 40,000.

The diagnosis arrived at was acute suppurative pancreatitis. The patient refused operation.

May 13, patient has grown steadily worse, very septic; abdominal pain has increased, is constant, and at times there are very sharp paroxysms. Abdomen is about the same; bowels have

been moved daily since admission. Temperature, 102.4° F.; pulse, 136. Leucocytosis, 36,000.

Operation, 11 P.M. Ether narcosis; thirty ounces of decinormal salt solution injected in vein of right arm. Ethyl chloride spray over site of tumor, and peritoneal cavity opened by a five-inch incision through left rectus muscle, and about twenty ounces of a brownish seropurulent fluid gushed out. It came from a cavity bounded behind by the lower edge of the stomach and gastrocolic omentum and upper border of transverse colon, the cavity being shut off laterally by adhesions from the general peritoneum. After mopping out the cavity, fat necrosis was observed in the gastrocolic omentum, the nodules varying from a pinhead to a pea in size. Behind could be felt a large mass posterior to the stomach and extending to the left, and by blunt dissection an opening was made into the bursa omentalis. This was followed by the discharge of over a quart of reddish-brown, thin pus containing considerable amount of white flakes and bits of necrotic fats. Opening enlarged sufficiently to admit two fingers, and the swollen pancreas could be distinctly felt lying to the back of a large cavity. A Ferguson speculum was then introduced through the opening, and with the aid of an electric hand light a circumscribed view of the pancreas was obtained. It was swollen, dark red in color, and here and there between the inflamed lobules could be seen areas of a yellowish-white color. The abscess cavity was irrigated thoroughly and gently with salt solution, a rubber drainage tube three-fourths of an inch in diameter and covered with iodoform gauze introduced into the cavity; the smaller cavity packed with sterilized gauze, large dressing of sterilized gauze and binder over all.

Patient decidedly weaker at the end of operation. Pulse 160. Ordered strychnine one-thirtieth of a grain hypodermically, and a stimulating enema of hot salt solution and extract of coffee.

May 14, patient somewhat improved. Abdominal pain decidedly less, pulse still rapid and weak. There is a profuse discharge of thin, brownish material from abdominal wound necessitating frequent dressing. Tympanites increased. During the next two weeks there was a gradual general improvement. Pulse was less rapid and stronger, the temperature lower, and the tympanites gradually subsiding. The discharge from the wound, however, was very profuse, and for the space of four inches around

the wound the skin became excoriated and inflamed in spite of the constant use of boric acid ointment. The edges of the wound, and especially the subcutaneous fat, became necrotic, and was of a greenish-black color.

On May 16 drainage tube removed, but was replaced on the 20th by a smaller one. The cavity was irrigated several times daily with salt solution, and considerable necrotic fats and blood-clots were washed out.

May 26, tube removed and drains of sterilized gauze substituted.

June 1, discharge contains large amount of fæcal matter.

June 8, general condition of patient not so good; is weaker; is delirious at nights; refuses to take food, and vomits several times daily moderate amount of greenish fluid. Stomach washed out every three hours, and through tube are introduced whiskey, one-half ounce, two raw eggs beaten up in eight ounces of peptonized milk. Nutrient enemata, t. i. d. This method of nourishment was resorted to until June 24, when the patient began to take food voluntarily. The wound is slowly healing, the discharge is less, and is principally fæcal matter; very little pus.

July 1, sits up in bed an hour daily. Wound three by one and one-half inches; at bottom can be seen small opening, which discharges fæcal matter.

July 14, out of bed. Fistula much smaller, discharge less. From this time the patient's history is that of steady convalescence and with slow decrease in the size of the fistula, and on September 10 he was discharged with wound completely healed.

May 15, 1902, patient is well and strong, and has gained sixty-five pounds since discharge from the hospital. Has a good appetite; bowels regular; stools of normal color. Two inches to the left and above the umbilicus is a scar five inches long and two inches wide, scar is firm, no protrusion on coughing. Patient wears abdominal belt.

It may be of interest to add some notes made by Dr. A. S. Chittenden (house surgeon) of experiments made on the secretions of the wound taken a few days after operation.

NOTES OF EXPERIMENTS ON SECRETIONS OF PANCREATIC FISTULA. (FLANNIGAN.)

SUGAR (*Amylolytic*). About three ounces of purulent secretion from epigastric fistula collected and filtered.

The resulting cloudy fluid was alkaline in reaction to litmus.

A sufficient quantity of dilute solution of boiled starch was prepared, which gave the characteristic blue reaction when treated with solution of iodine.

In four test-tubes was placed an equal quantity of the dilute starch solution (temperature, 40° C.), and each was then treated successively, and about one minute apart, with five minims of the filtered secretion from the fistula.

The tubes were again treated in series, and about one minute apart with a solution of iodine.

Tube No. I gave the reaction (blue) for iodine (slightly impaired).

Tube No. II gave a purple color (erythrodextrin).

Tube No. III gave a cherry-red color (erythrodextrin).

Tube No. IV was colorless.

Upon boiling a portion of the contents of tube No. IV with Fehling's solution, the red oxides of copper appeared.

FATS (*Adipolytic*). Olive oil was shaken with ether and caustic soda, and the supernatant neutral ethereal solution of fat separated off. Evaporation left a fat neutral in reaction to litmus. To this was added a small amount of litmus and five minims of the prepared secretion from the fistula. The whole was kept warm, 40° C., for two hours, when the blue color of the litmus had gradually given place to red, showing the decomposition of neutral fat into glycerin and fatty acid.

PROTEIDS (*Proteolytic*). The white of an egg was chopped fine and mashed in running water. A sufficient quantity of this was placed in a test-tube covered with twenty cubic centimetres of water, to which five minims of chloroform had been added.

To this was added five cubic centimetres of the prepared secretion from the fistula. The test-tube was then kept in a thermostat of constant temperature of 38° C. for thirty-six hours. At the end of that time complete solution of the coagulated albumen had resulted. This milky solution upon dilution gave the biuret reaction. No tests for leucine or tyrosine were made.

The pathologist of the hospital, Dr. Biggs, also reported that the fluid removed at the operation responded to all tests for pancreatic juice.

Examination of two good sized masses of tissue found in fluid evacuated at operation showed necrotic pancreatic tissue.

Cultures of this material revealed the abundant presence of the staphylococcus albus.

Remarks.

This was a case of acute pancreatitis with suppuration, and its rapid progress is unusual, for, as a rule, this variety is subacute and runs a slow course even when the onset is sudden. In this case the infection of the pancreas started from the duodenum, where, owing to the continued and at times the increased use of alcohol, gastroduodenitis existed.

The infection dates back probably to the time of the first attack of pain and vomiting, and it assumed the form of a simple catarrh of the ducts, which was aggravated and increased by the frequent sprees, and finally resulted in a suppurative form of catarrh. From the continual ingestion of alcohol and the repeated sprees, the pancreas was in a state of congestion with increased secretion, and, owing to the diminution of the caliber of the pancreatic ducts, there was a certain degree of retention of the pancreatic secretions and an increase of tension in the excretory ducts and alveoli. As a result, changes in the epithelial lining of the excretory ducts and alveoli took place, the epithelium of the ducts being destroyed in spots and the cells lining the alveoli undergoing a fatty degeneration. The bacteria present in the ducts were increased in number and degree of virulency and gaining access to the alveoli, suppuration of the degenerated epithelia followed, thus causing a true pancreatic abscess; or the bacteria penetrated the wall of the duct where the epithelial coat was destroyed and, gaining access to the periglandular tissue, produced a suppurative peripancreatitis. The abscess thus formed steadily increased in size, burrowed forward in the gland and perforated into the bursa omentalis, which then became a large abscess cavity. The infection evidently spread from here forward through the gastrocolic omentum and produced a localized, suppurative peritonitis, which was represented by the first abscess opened at the time of operation.

This existence of an intraperitoneal abscess secondary to

and with no direct communication with the abscess of the bursa omentalis is interesting and very unusual.

In arriving at the diagnosis in this case, I was assisted partly by the length of time—thirteen days—which had elapsed since the beginning of the last attack and in a greater degree by the presence of the tumor in the left epigastrium. Had I seen the patient at the beginning of the attack, a diagnosis would have been impossible, as the symptoms were those which accompany other diseases of the upper alimentary tract. As the bowels had been moved daily since admission, intestinal obstruction was excluded. The history of the previous attacks with no vomiting of blood or bloody stools, together with the fact that almost fourteen days had passed since the beginning of the last one, ruled out, in my mind, perforative inflammation of the stomach or duodenum, which, as a rule, are fatal in a few days. Gall-stone was excluded by the absence of jaundice and the pain being most intense over the left epigastrium. The most characteristic symptom was the presence of the tumor, which was apparently situated between the stomach and transverse colon, the usual location where pancreatic cysts present, and its dulness was continuous with the dulness developed on deep percussion over the stomach and extending into the left epigastrium. The presence of fever and rapid pulse and the very high leucocytosis suggested suppuration. Finally, the occurrence of the attack following directly upon a spree was of some importance to me, as in a case of suppurative pancreatitis seen some years ago, where the diagnosis was not made until after operation, the attack followed immediately after a debauch.

From the history of the attacks always following a spree; from the ability to exclude other affections whose symptoms in the beginning are the same in acute pancreatitis; and, finally, from the presence of the tumor over the site of the pancreas, made it possible to arrive at a diagnosis.

After the patient was anæsthetized, on palpation over the stomach a mass could be felt extending into the left hypogastrium, and it was considered to be connected with the tumor

which lay between the stomach and transverse colon. Owing to the prominence of the tumor in the left epigastrium, an anterior incision was employed, and it was evidently the better route of approach, as a posterior incision in the costovertebral angle would have failed to drain the intraperitoneal abscess. Owing to the weak condition of the patient, after opening and draining the omental bursa from the front, it was deemed safer not to prolong the operation by attempting drainage from behind. Perhaps it would have been better to have added a posterior incision, as it would have afforded better drainage, and would have been followed by a quicker recovery, as well as avoided the formation of a fæcal fistula; but, as mentioned above, the patient's condition was such as not to allow of any prolonged operative interference. The fæcal fistula was due to the mistaken zeal of one of the internes, who considered the drainage insufficient, and with every good intent substituted the rubber drain, and as a result fæcal material appeared in the discharge two days thereafter.

The healing of the abdominal wound was thus materially delayed, and but for this complication, the patient would have been discharged at least six weeks sooner.

On July 1, the pancreatic abscess was entirely healed, as at that time the discharge was mainly fæcal and contained no pus.

The pancreatic abscess in this case was evidently a single one, as is the rule of 60 per cent. of reported cases, and the damage to the gland through suppuration was of limited extent, as can be appreciated by the present condition of the patient. He has steadily gained in weight, his digestion is good, his stools are of a normal consistency and color, the urine contains no sugar, and the pancreas apparently functionates in a satisfactory manner.

CHOLECYSTECTOMY *VERSUS* REMOVAL OF THE MUCOUS MEMBRANE OF THE GALL-BLADDER.

By EMIL RIES, M.D.,

OF CHICAGO.

In the development of surgical work on gall-stones in the gall-bladder, three epochs have been passed through which may be differentiated by the principles dominating the operator's mind and guiding his hand. The first epoch was characterized by the idea that these stones themselves are the cause of all the trouble, and, therefore, their removal alone was the aim of the operation, and the sooner the gall-bladder was closed, the more successful the operation was thought to be. Cholecystendysis, the so-called ideal operation, seemed to fulfil the requirements; to-day, it is practically abandoned. It soon became clear that there was a second factor of supreme dignity in the pathology of cholelithiasis, the diseased mucous membrane of the bile tract.

Cholecystostomy, the operation of opening the gall-bladder and leaving it open for the purpose of drainage and local treatment of the gall-bladder and ducts, then was considered the supreme remedy. As, however, the reports of biliary and mucous fistulæ, of stones overlooked or reformed, of strictures and inflammatory processes accumulated, a further step was taken, and the removal of the entire gall-bladder with the cystic duct, or cholecystectomy, entered into competition with the older methods.

The removal of the gall-bladder is, as a rule, neither a difficult nor a dangerous operation. Kehr,[1] for instance, reports, in over 100 operations of this kind, a mortality of about

3 per cent.; he has frequently performed the operation in one-half hour. He declares that he is performing this operation at present more frequently than any other gall-stone operation, and that he is better satisfied with the remote results from this procedure than from any other rival operation. This latest and most radical operation on the gall-bladder is, of course, unanimously recommended by all surgeons in cases where the gall-bladder is the seat of malignant or such acute inflammatory or necrosing processes as make its preservation an impossibility. In cases of chronic inflammation, however, where the gall-bladder is thickened, where it is small, where it may or may not contain stones or sand, where it is adherent to neighboring organs, cholecystectomy is only one of several operations that will come under consideration.

We do not think that cholecystenterostomy, the formation of an anastomosis between the gall-bladder and some convenient portion of the bowel, is to be discussed here as a competing operation, because this procedure is often difficult of performance in this particular instance, and appears uncertain in its outcome because it would seem to favor infection of the bile tract. Two other methods, however, have attracted considerable attention in the treatment of these contracted gall-bladders. One, the drainage by a tube inserted into the gall-bladder and made water-tight after suturing the gall-bladder opening around it (Kehr,[1] Poppert,[1] Mayo[2]), and the other, Mayo's method[2, 3] of removal of the mucous membrane of the gall-bladder.

The first operation of the water-tight insertion of a rubber tube into the gall-bladder is good enough in an emergency, if the operation is a tedious one on account of complications, adhesions, etc., but just in such cases secondary operations are quite frequently required. Mayo[3] describes this condition most admirably in the following words: "After the removal of the external drainage, the thickened walls of the gall-bladder continue to contract, interfering with the drainage through the ducts from the islands of mucous membrane not previously destroyed, and a condition results resembling a chronic ap-

pendicitis in many aspects." He recommends cholecystectomy in such cases, and therein agrees with the majority of surgeons. Mayo[2] offers, as a substitute for the cholecystectomy, the removal of the mucous membrane of the gall-bladder. "Especially," says he, "is it as a secondary operation that the removal of the mucous membrane is most serviceable; that is to say, where a cholecystostomy has been performed without accomplishing the desired results."

This removal of the mucous membrane, according to Mayo, is done by pulling it from the underlying tissues, and is said to be easily performed. The hæmorrhage is insignificant, and requires, at the worst, one or two ligatures, or the twisting of some small vessels. After the removal of the mucous membrane, the cystic duct is ligated, and drainage is carried down through the remaining muscular and connective-tissue coats of the gall-bladder to the stump of the cystic duct. Mayo and others have performed the operation with good results.

Some observations in the surgical pathology of the gall-bladder which I have recently made have convinced me that this operation of removal of the mucous membrane of the gall-bladder is subject to serious objections, which I think ought not to be overlooked. The case on which these observations have been made is the following:

Mrs. L., forty-five years old, has passed gall-stones several times, first, eighteen years ago, then two years ago, then for several months before I operated. The stones have been from the size of a hazel-nut down to very small concretions. She has never had jaundice, but severe colics have preceded the passage of stones every time. For the past two years the patient has not been entirely free from pain at any time. She was not jaundiced when I first saw her. The region of the gall-bladder was painful on pressure; otherwise, examination had negative result.

The operation revealed a small, hard gall-bladder low down, adherent to the omentum, colon, and duodenum near the pylorus. It was dissected out from its adhesions and from the liver, the cystic duct tied off with catgut close to the common duct, and

the gall-bladder was removed. On opening it, five small stones and a quantity of sand were discovered in the gall-bladder. The cystic duct was closed by inversion of its walls, a piece of omentum was sutured over the stump, and a strip of gauze passed down to the stump. After covering all raw surfaces of the bowel by sero-serous sutures, the abdomen was closed, with the exception of a small opening through which the gauze was permitted to protrude. The patient made a good recovery, and left the hospital eighteen days after operation in very good health, and the wound closed with the exception of a very small, granulating portion of the skin, which has closed since. The operation was done in January of this year, and I have heard from the patient since then; she is in excellent health.

The most important feature of the case was the examination of the removed gall-bladder. The wall of the gall-bladder was six millimetres thick. Of this, about one millimetre is muscular coat and mucous membrane; the rest is connective cicatricial tissue and serous coat. The thickness of the muscular coat is about four times that of the mucous membrane. The mucous membrane is covered with the normal columnar epithelium of the gall-bladder, and the glands of the mucous membrane show secreting epithelium. Between the glands of the mucous membrane, foci of round-cell infiltration are to be seen which penetrate the muscular coat following the blood-vessels. The most important finding concerning the glands is that they penetrate the muscular coat so that their fundus appears beyond the external surface of the muscular coat and is embedded in the connective tissue of the subserous portion. These glands are invested with apparently perfectly normal columnar epithelium; there is no multiplication of layers, there is no atypical arrangement, and there is no metaplasia of the cells. The subserous, thickened, cicatricial tissue contains occasional foci of round-cell infiltration, but these remnants of inflammation are few and far between. The serous coat presents nothing abnormal.

Leaving out of consideration all other features of this pathologic condition, the most important observations have

Wall of removed gall-bladder.—M, mucous membrane; G, gland penetrating muscular coat; Msc, muscular coat; S, serosa.

been made on the glandular elements of this gall-bladder. We find that the glands, instead of being confined to the mucous membrane, penetrate the muscular layer and appear between this and the serosa. We have to deal with abnormal growths of the glands, as we see it occasionally also in other organs composed of mucous membrane and muscular wall, as, for instance, the uterus and stomach. It is not too much to say that here is morphologically the connecting link between the benign hypertrophy and the malignant, destructive growth.

Now, as to the surgical significance of the case, it is very evident that, in attempting to remove the mucous membrane of this gall-bladder, an operator would undoubtedly have removed muscularis with the mucosa, so that, in attempting the removal of the mucosa alone, he would have removed more than he intended to remove. Furthermore, it is evident that if, instead of removing the whole gall-bladder, Mayo's operation of removing the mucous membrane alone had been performed, glandular elements would have been left behind in the remaining wall of the gall-bladder, and what would have been the outcome? The outcome would have been just what Mayo correctly describes as above quoted: "Islands of mucous membrane not destroyed by the operation would have continued to secrete; a condition much resembling chronic appendicitis" would have been created artificially and the result of the operation would probably have been a disappointment.

It is perfectly true that in the operations performed by Mayo and others no bad results have been reported, but the time during which this operation has been done is short, and the number of cases is not large as yet. On the other hand, we have most excellent clinical and experimental evidence with which to support our contention that the danger from such remaining glands is more than imaginary or theoretical. First of all, we know, by the experiments of Oddi[4] and those of Voogt,[5] that after the removal of the gall-bladder the remaining mucous membrane of the cystic duct grows abundantly, so as to give rise to a sort of new gall-bladder, and the mucous membrane of the cystic duct is genetically and his-

tologically the same as that of the gall-bladder. Therefore, remnants of glands left behind might give rise to cystic formations. Second, unintentionally similar experiments have been made clinically on an organ constructed on similar lines, —the uterus. It has been observed here that, after unwise curettement of the uterus, part of the uterus became obliterated, proving what destruction of mucous membrane in that part of the uterus would do; while behind the destruction a hydrometra formed, the contents being produced by the patches or islands of mucous membrane reproduced from the ends of glands left in the depth between the muscular fibres in the same way as a pulling off of the mucous membrane of the gall-bladder would have done in the above case. In the course of severe inflammatory processes of the uterine mucosa, a similar result has been observed after partial necrotic destruction of the mucous membrane.

We, therefore, have to take into account the possibility of the formation of a retention tumor in the remnant of the gall-bladder after apparently complete removal of the mucous membrane. Such a retention tumor would have the same pathology and clinical dignity as a hydrops of the gall-bladder due to stricture of the cystic duct, a condition that is best treated by cholecystectomy.

My conclusion, therefore, is that the removal of the mucous membrane of the gall-bladder is a step in the wrong direction, and ought to be abandoned in favor of the more radical, more reliable, and hardly more dangerous cholecystectomy.

LITERATURE.

[1] Kehr: Münchener medicinische Wochenschrift, February, 1900.
[2] Mayo: Journal of the American Medical Association, 1900.
[3] Mayo: ANNALS OF SURGERY, 1899.
[4] Oddi: Quoted after Voogt.
[5] Centralblatt für Chirurgie, November, 1898.

REMOVAL OF THE BLADDER AND PROSTATE FOR CARCINOMA THROUGH A SUPRAPUBIC OPENING.[1]

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As a contribution to the subject, "The Choice Between the Suprapubic and Infrapubic Methods of Reaching Tumors and other Surgical Lesions of the Pelvic Organs," the following case is presented:

Mr. G., aged fifty-three years. No hereditary tendency, so far as known, to malignant disease. His general health had been good up to the time of the present trouble. About a year ago he accidentally discovered blood in the urine. This soon disappeared, but after a short time was again noticed. From now on we find a history of gradually increasing frequency of urination with intermittent hæmaturia and pain. After some months his general health began to fail, so that when he presented himself to the author, on October 2, 1901, for examination, it was found that he had lost considerable flesh and was suffering quite a little pain in the region of the neck of the bladder, and was obliged to urinate rather frequently, day and night. The urine contained blood, the amount of which varied considerably from time to time. There was also a small amount of pus and some albumen, probably depending upon the amount of blood and pus present. No casts nor tubercle bacilli were found. Upon rectal examination the prostate was found somewhat enlarged, quite firm, irregular, and tender. The passage of a sound was very painful. On this account an anæsthetic was given in order to make a cystoscopic examination. The cystoscope revealed a bleeding mass, involving the trigonum and extending beyond the ureteral openings. A diagnosis of car-

[1] Read before the American Surgical Association, June, 1902.

cinoma of the bladder, probably extending to the prostate, was therefore made. As no other abnormal conditions were found on examination, an operation was advised.

The operation was performed October 5, 1901, in the following manner: A median longitudinal incision, about eight centimetres in length, was made just above the symphysis and opening into the cavum Retzii. The peritoneal fold was crowded upward, the bladder exposed, opened, and the growth carefully examined. This was found to involve the entire trigonum and to extend quite a little above both ureteral openings. It was apparent that the growth in the bladder wall had involved the prostate, and it would, therefore, be necessary to remove the base of the bladder and entire prostate *en masse*. The bladder was freed by blunt dissection on each side as far down as the base. The urethra was now divided close to the triangular ligament, and beginning at this point and working backward and upward the prostate and bladder were separated from the rectum. This, which was the most difficult part of the operation, was much facilitated by an assistant introducing two fingers into the rectum, thus raising all the parts well forward. The hæmorrhage during this part of the operation, although considerable, was not as severe as was anticipated, and was materially lessened by keeping the bladder well drawn forward; that is, towards the suprapubic opening, as fast as it was separated from the rectum. The ureters, as soon as they came into view, were easily divided beyond the disease. The right ureter was considerably enlarged and tortuous, owing to the obstruction which the growth had produced at the ureteral opening. Some small, enlarged lymph glands which were found in the connective tissue to the side of the bladder were removed. As the vertex of the bladder was not involved in the diseased process, a portion of it, about six to seven centimetres in diameter, was retained. The remainder of the bladder and prostate were removed. Small slits were made in the remnant of the bladder, and the ureteral ends drawn through and stitched with catgut. This small portion of bladder was then stitched by its edge to the inner edge of the suprapubic opening, except at the lower part. The cavity in the pelvis was packed with gauze and a large rubber drainage-tube inserted to the bottom of the cul-de-sac. The peritoneal cavity was not opened. Time of operation, about one hour and thirty minutes. There was considerable shock following the operation,

but this was slowly recovered from, and in about two weeks the patient was able to sit up. The cavity filled in quite rapidly, and the tube was soon dispensed with. In about a month the patient had gained in strength so as to be up and around. The ureteral openings in the small, practically exstrophied bladder were easily seen, and the urine escaping from them was clear and, on analysis, normal, with the exception of a small amount of pus from the surrounding parts. On drawing the edges of the suprapubic opening together the lower part of the small bladder would dip slightly behind the upper edge of the symphysis pubis. A catheter introduced through the penis reached the small bladder, and nearly all the urine would drain off through the catheter. It was, therefore, retained permanently in position. The patient was walking out of doors daily, and his general health was improving rapidly. During the latter part of November, while out of doors one day, he was taken with a chill and developed a right-sided croupous pneumonia, from which she died December 3, 1901.

Autopsy, shortly after death, by Dr. Herzog, Professor of Pathology, Chicago Policlinic. Recent plastic lymph over lower portion of right pleura, with small amount of serous fluid in the pleural cavity. Lower half of right lung in beginning gray hepatization of croupous pneumonia. Left lung congested. Heart normal. Liver, spleen, and intestinal tract normal. The kidneys, ureters, remains of bladder, penis, and rectum, together with the surrounding tissues, were removed in a mass for study. The right kidney was small and atrophied, measuring seven and a half by four by three centimetres. Interstitial nephritis. The left kidney measured eleven and a half by seven and a half by four centimetres. It was normal in structure. The ureters were patent throughout and their openings free. The right ureter had contracted again to about its normal size. Considerable connective tissue was found between the small bladder and the rectum and the lateral walls of the pelvis. An interesting point is the remarkable formation of a tongue-shaped process lined with epithelium, continuous with the lower end of the bladder, surrounding the catheter, and extending almost to the posterior end of the urethra, a distance of some five or six centimetres. Metastases were found in the shape of a few enlarged glands near the bifurcation of the aorta and one quite large lymph gland near the hilus of the left kidney.

Microscopical examination of that portion of the bladder and prostate removed at the operation: That portion of the section directed towards the interior of the bladder presents a marked proliferation of atypical epithelial cells, the surface being ragged and irregular. As we proceed towards the deeper parts the epithelial mass sends out prolongations of epithelial cells, which soon break up into typical epithelial masses surrounded by connective tissue of varying thickness, thus forming distinct alveoli. The muscular layer is broken in places where it is penetrated by the epithelial masses. These masses extend into the prostate itself, which is quite extensively involved in the process. The microscopical examination thus leaves no doubt as to the carcinomatous nature of the growth, which began in the mucosa of the bladder and involved, secondarily, the prostate gland.

It is not the intention to present a detailed analysis of the cases of extirpation of the bladder, partial and complete, for carcinoma, as that has already been done by Wendel (*Beiträge zur klinischen Chirurgie*, 1898, Band xxii, S. 243). According to Wendel, the immediate mortality after complete extirpation is 60 per cent. (ten cases, six deaths). After partial extirpation, 24.5 per cent. (fifty-seven cases, fourteen deaths). This enormously high death-rate is due mostly to two causes, viz., shock or collapse and uræmia. The first of these, or shock, in some degree is almost a necessary accompaniment of so serious and severe an operation as urocystectomy, and will only be materially reduced when an improved technique diminishes the amount of blood lost and cuts short the time of the operation. The other cause of death, uræmia, is due to the prolonged effect of the anæsthetic on perhaps already diseased kidneys and to the necessity of interfering with the ureters. The implantation of the ureters into the rectum or other part of the bowel, as was done in a number of these cases, has now been shown to be an unjustifiable operation, as death is almost certain to follow, sooner or later, from an ascending pyelonephritis. In the female the vagina provides a means of escape from this dilemma, but this is denied us in the male. It is, therefore, particularly in this class of subjects that the plan of retaining a portion of the bladder wall, however small it may be, into which the ureters

are to be implanted, and the whole to be partially stitched in the depth of the lower angle of the wound as near the posterior end of the urethra as possible, as described in the case here recorded, is recommended. It is very rare, indeed, when the bladder is so extensively involved in the carcinomatous process that a small portion of its wall, from some part or another, cannot be saved. It is all the more favorable to this method that the mucosa of the bladder contains no lymphatics, and metastasis in the mucosa by means of these channels is thus not the rule.

The reproductive power of the bladder is so remarkably great that even the smallest portion saved may, in a short time, develop into quite a comfortable receptacle for the urine. The author's intention was first directed to this fact by a case of traumatic rupture of the posterior urethra in a bicyclist. After his fall he found he was unable to urinate, and, being some distance in the country, was obliged to ride his wheel several miles to the city before he could secure relief. The physician whom he consulted endeavored to draw the urine with a metal catheter, and in doing so made several false passages leading into the prevesical space and injured the anterior wall of the bladder. Extravasation of urine throughout the prevesical space and perineum occurred, to which infection was soon added. When first seen by the author he was in a serious condition. A suprapubic incision was made and the bladder found in a sloughing condition. A large slough several centimetres in diameter, and composing the major portion of the bladder, with the exception of the trigone and a bit of the posterior wall, was removed. A perineal incision was added, and through-and-through drainage established. After some months the perineal and suprapubic openings closed. He could hold his urine at first an hour or so, and later five or six hours, and could go all night without difficulty. In this case practically an entire bladder was reformed from the base.

The remarkable regenerative power of the bladder has likewise been shown by Schwarz.[1]

[1] Lo Sperimentale Anno xlv, Fasc. v.-vi, p. 484. Ref. Deutsche medicinische Wochenschrift, 1892, S. 696.

The points to which it is desired to direct attention in this brief article are:

(1) The suprapubic route for the removal of the bladder and prostate for malignant growths.

(2) The method of operating, which consists in dividing the urethra at the triangular ligament, and working from before backward in separating the prostate and bladder from the rectum, aided by an assistant's fingers introduced into the bowels.

(3) The use of constant traction on the bladder towards the suprapubic opening as fast as liberated from bel[illegible]s a means of materially reducing the amount of hæmorrhage.

(4) The retention of a portion of the bladder wall, however small, into which the ureters are to be stitched, and the whole to be fixed as near the posterior end of the urethra as possible, with a view to its ultimate regeneration into a serviceable bladder.

RESULTS OF OPERATIONS ON THE KIDNEY FOR TUBERCULOSIS.

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From various sources the author has collected 194 cases in which some operation on the kidney was done for tuberculosis. To these may be added those in Bangs's table (Annals of Surgery, 1898, Vol. xxvii) and also those in Facklam's (Die wegen Nierenphthisie vorgenommenen Nephrotomien, etc., *Archiv für klinische Chirurgie*, 1893, Vol. xlv, p. 715), making 415 cases in all. We are at once struck with the small number of cures. Thus, in the author's list there are but forty-one out of 194 in which at the end of two years or more the patient was still well; in Bangs's list there were but ten in 135; and in Facklam's there were but seven in eighty-eight. Reduced to percentages, these cures are 21 per cent., 7.4 per cent., and 7.9 per cent., respectively. It is encouraging to observe that the later statistics are the most favorable. This is due to the fact that the operative cases have been, within recent years, more carefully selected as to fitness for operation, and that, with improved methods of arriving at a correct diagnosis, the patients have been operated upon early in the course of the disease. In most of the early cases cited, the diagnosis was arrived at from focal symptoms rather than from finding bacilli or from cystoscopic aid.

These results are disappointing. The reason they are not better is because renal tuberculosis is rarely primary in the kidney, there being a primary focus elsewhere in the body from which the renal tuberculosis takes its origin, and which may

and does in many instances cause subsequent death, even if the urinary tuberculosis has been eradicated by surgical means. In twenty-four cases of caseous tuberculosis of the kidney occurring in 3424 autopsies at the Boston City Hospital and in the Massachusetts General Hospital during the past ten years, the kidney was never the only tuberculous organ in the body. In one of the twenty-four cases the primary focus of the disease was a tuberculous retroperitoneal lymph gland, and in another case it was a mediastinal lymph gland. Obsolete tuberculosis of the lung was present in two other instances, and served as a focus for the disease in the kidney. The cases of primary glandular tuberculosis must be explained as the result of their filtering the germs either swallowed or inspired. The distribution of the various foci of tuberculosis, sometimes alone and sometimes together, in the other cases was as follows: Lungs thirteen times, pleuræ twice, intestines six times, mediastinal glands eight times, retroperitoneal glands three times, larynx once, Fallopian tubes once, uterus once, prostate once, spinal column once, abdominal cavity once, liver once. In addition to these foci, miliary tuberculosis was found thirty times in various organs. It was, of course, impossible to determine how old these foci were; and it may be argued that they may have been secondary to a primary focus in the kidney. There is no means of proving that this is not so, and the question will probably never be satisfactorily answered. It could be answered only by autopsies in early cases of renal tuberculosis, and as the disease is rare it is probable that many years must elapse before the ultimate solution of the question.

Morris ("Surgical Diseases of the Kidney and Ureter," London, 1901, Vol. i, p. 484) is quite in accord with these findings, and he says that occasionally the kidney is found at autopsy to be the only organ actively diseased, but that old foci of cured tuberculosis are always found in the prostate, testicle, or lungs. He gives fifteen cases of caseous renal disease in 2610 autopsies occurring at the Middlesex Hospital.

When we consider the greater facility for infection that is presented to organs in more direct communication with the air, we may safely conclude that the primary focus of the disease is rather in these organs (lungs, intestines, etc.) than in the kidney, which from its situation is less exposed in this way.

Of the 415 cases analyzed by the author there were 122 deaths, immediate and remote, and of these deaths tuberculosis in some other organ was the cause in forty-nine instances; the remaining deaths were due to some other cause or were included in the operative mortality. Tuberculosis of the opposite kidney was reported in twenty-four cases (5.7 per cent.). The lungs were most frequently affected, and undoubtedly was the starting-point of the disease in many instances. Unquestionably, tuberculosis elsewhere in the body existed many more times than was reported. This was through omission to report the condition or through inability to recognize latent tuberculosis, such as occurs in mediastinal or retroperitoneal glands. That these latent foci may cause a further outbreak is a matter of record. After two of the nephrectomies, death occurred in one instance seven years after the operation from tuberculosis of the opposite kidney, and in the other eight years after the operation from general tuberculosis. On the other hand, there were some brilliant cures, the most remarkable of which was one of Czerny's cases (No. 62), in which cure had persisted for twenty-one years after the operation without there being any tubercular manifestation in the meantime. But such cases are exceedingly rare, and a patient who has been operated upon for renal tuberculosis should never consider that the future is safe. The corollary of this is that patients should take the utmost care of themselves in order to maintain their constitutions up to the highest possible pitch of vigor, for by this means only may they hope to keep in check the disease which is lurking somewhere within them.

The comparison between nephrectomy and nephrotomy is a striking one. As the author's statistics of 194 cases are the most recent ones, they alone may be referred to in com-

paring these operations. The difference in mortality is very marked,—17.4 per cent. in nephrectomy and 46.6 per cent. in nephrotomy. This result was perhaps due to the low condition of the patient at the time of the operation. Many of the patients were allowed to drag along in a septic condition for months before the operation, which had then become an operation of urgency. We cannot, therefore, draw any just conclusions from the cases taken as a whole. One operator seems to have made it his purpose to study the effect of nephrotomy. Reference is made to Czerny's cases, reported by Simon (*Beiträge zur klinischen Chirurgie,* Tübingen, 1901, p. 40. See Cases 37 to 68). He had only seven cases in which nephrotomy was the only operation performed. In all the other cases, to the number of fifteen, in which nephrotomy was the primary operation, a secondary nephrectomy was necessitated later, on account generally of persistent fistula combined with the low condition of the patient. Of the seven cases of nephrotomy, in only two were there permanent cures (Nos. 61 and 62), one still alive and well at the end of five years, and the other well at the end of four years. The remaining cases were either dead or not improved. There were four permanent cures, from two to nine years in duration. This seems like a large showing, but it must be remembered that the nephrotomies followed by nephrectomies should be added to the nephrotomies alone. If we do this, the percentage of absolute cures two years after the operation of nephrotomy is but .56 per cent.

The reason why the operation fails is because fistula results. A condition of sepsis is thus produced, and with it is the added danger of there being present a tubercular focus, which may be the source of origin of tuberculosis elsewhere in the body. It may safely be asserted that nephrotomy alone will offer but a slight chance of permanent cure.

But in nephrotomy followed by nephrectomy, we have an operation which offers the greatest encouragement. In forty-seven such cases there were but five deaths, a mortality of only 11.9 per cent., much better than in the case of nephrec-

tomy alone, which gave a mortality of 17.4 per cent. More striking yet is the number of permanent undoubted cures; they are twelve in number, ranging in duration from two to twelve years. As compared with permanent cures after nephrectomy alone, the percentage is 25.4 and 13.8 in favor of nephrotomy followed by nephrectomy. Too much stress must not be placed upon these figures, however, and they are not offered as a claim that this procedure should be adopted in all cases. It is probable that the cases were those in which there was a large abscess which was drained; the patient was then allowed to recuperate until the general condition warranted the nephrectomy.

The mortality after nephrectomy, 17.4 per cent., is the best on record, Bangs's being 21.7 per cent., and Facklam's being 26 per cent. Undoubtedly this will be improved upon as time goes on.

Among the 415 cases there were six cases in which resection of the kidney was done. There was no operative mortality. In one case the patient was losing ground at the end of a year; in another the patient was well three years later; in the third the time was not stated. Of the other three cases, one occurred in Bangs's list, and was well at the end of a year; the other two were in Facklam's list, and one of them was well at the end of eleven months, and the other died four months after the operation.

This seems like a favorable showing, but, nevertheless, the operation is one which involves risk as to subsequent disease. Albarran (*Annales des Maladies des Organes Génito-Urinaires*, 1899, Vol. xvii, p. 358) condemns it, claiming that the tissue apparently not affected by the disease is not healthy tissue, as proved by the non-permeability of methylene blue through it. König and Pels-Leusden (*Deutsche Zeitschrift für Chirurgie*, 1900, Vol. lv, p. 35) also condemn it, basing their opinion upon a pathological study of sixteen kidneys. In not one of these kidneys was the renal parenchyma such as to have warranted a resection; the renal pelves particularly were diseased.

Ureterectomy, partial and total, with nephrectomy is an operation which deserves great attention. It is the ideal operation because it removes the whole focus of disease, save the in the bladder, and theoretically it ought to offer the most favorable chance for cure.

Taking up first the total ureterectomies in the 415 cases, we find sixteen cases with but a single death. The final results are most excellent. Of the sixteen cases, three have survived two years or more, and all the rest were doing well at the time of the report except one, which was improved only. Of the partial resections of the ureter with nephrectomy, there were ten, with no mortality. One of these died later, three were improved; in three the duration was not given, but they were doing well, and in the other three progress was satisfactory.

Of the cases in which the ureter was known to be diseased and was left *in situ* there were thirty-six. Analyzed, these cases were as follows:

Total number		36
Operative recoveries		25
Operative deaths		11
Percentage of operative deaths		30 per cent.
Operative deaths		11
Pulmonary phthisis	3	
Tuberculosis opposite kidney	2	
Cause not stated	2	
Uræmia	1	
Exhaustion	1	
Anuria	2	
	11	
Deaths later		7
One year or under	6	
Tubercular meningitis	1	
Tuberculosis opposite kidney	2	
Pulmonary phthisis	2	
Cause not stated	1	
Seven years	1	
Tuberculosis opposite kidney	1	
	7	

Improved	5
(Duration, a few months to five years. Persistent pyuria.)	
Recoveries. Duration not given	5
One year or under	2
Two years	3
Four years	3
	36

We note that complete recovery may take place even if the ureter has been abandoned. On the other hand, the mortality is quite large, 50 per cent., the deaths being either immediate, 30 per cent., or remote, 20 per cent. The cause of death in almost all the cases was tuberculosis in some form, suggesting at least that the tuberculous ureter might have been the infecting focus. In one case such a result took place after a lapse of seven years. Among the ill results following the abandonment of the ureter are fistula, secondary abscess if the ureteral stump is buried, continuance and persistence of urinary symptoms.

McCosh (ANNALS OF SURGERY, 1899, Vol. xxix, p. 757) reports the case of a man, nephrectomized three years previously, in whom a secondary abscess developed at the site of the ureteral stump. In another of his cases a secondary ureterectomy was required after nephrectomy, the ureter having become enlarged by collection of pus within it. Kelly and others have had similar experiences. It is known, however, that a tuberculous ureter, if the kidney has been removed, will sometimes atrophy. Brown (ANNALS OF SURGERY, 1899, Vol. xxix, p. 757) relates the case of a boy in whom the ureter, enlarged by the tuberculous changes, atrophied and became diminished one-fifth in size after nephrectomy, but the boy died seven months later of tubercular meningitis, and at the autopsy tubercle bacilli were found in the ureter.

To sum up, therefore, it appears that if the ureter is abandoned, further complication may be expected, and the most to be dreaded is death from tuberculosis in some other part of the body. The excellent results obtained by total and partial ureterectomy encourage the belief that it will be done

more frequently in the future. It is probable that these cases were for the most part, at least, in individuals who were in a fair state of health at the time of the operation, otherwise the operative mortality must have been higher. It seems proper to insist that nephro-ureterectomy should be done in all cases in which the condition of the patient warrants it. The added risk is very slight. If the patient's condition does not seem such that its performance should be immediately undertaken, the operation should be left until a future time. As to the choice of route, lumbar or abdominal, it is too early to formulate rules. The lumbar route is easy, there is plenty of room, and the dangers are slight in an uncomplicated case. Hæmorrhage from the high vaginal arteries in the female should be guarded against if the operation is terminated through the vagina. The abdominal route is easier of performance, but there should be more danger from septic complications.

Comparison of Results.	G.	B.	F.	Garceau's List.	Bangs's List.	Facklam's List.
Nephrectomies				101	84	72
Operative recoveries	86	69	57			
Operative deaths	15	15	15			
Percentage of operative deaths	17.4	21.7	26			
Deaths later	12	6	7			
No improvement	1	1	0			
Improved	10	15	7			
Recoveries (duration not given)	32	9	23			
One year or under	17	28	13			
Two years	4	7	3			
Three years	2	1	2			
Four years	3	1	2			
Five years	1	0	0			
Six years	0	0	0			
Seven years	1	0	0			
Eight years	1	1	0			
Nine years	0	0	0			
Ten years	0	0	0			
Eleven years	1	0	0			
Twenty-one years	1	0	0			
	86	69	57			

Comparison of Results.				Garceau's List.	Bangs's List.	Facklam's List.
Nephrotomies				22	20	0
	G.	B.	F.			
Operative recoveries	15	14	0			
Operative deaths	7	6	0			
Percentage of operative deaths	46.6	42	0			
Deaths later	4	5	0			
No improvement	0	0	0			
Improved	1	1	0			
Recoveries (duration not stated)	3	3	0			
One year or under	2	3	0			
Two years	1	1	0			
Three years	0	0	0			
Four years	3	0	0			
Five years	0	1	0			
Six years	0	0	0			
Seven years	0	0	0			
Eight years	0	0	0			
Nine years	1	0	0			
	15	14	0			

Comparison of Results.				Garceau's List.	Bangs's List.	Facklam's List.
Nephrotomies followed by nephrectomies				47	25	12
	G.	B.	F.			
Operative recoveries	42	19	8			
Operative deaths	5	6	4			
Percentage of operative deaths	11.9	31	50			
Deaths later	8	3	1			
No improvement	0	1	0			
Improved	8	1	0			
Recoveries (duration not stated)	8	6	5			
One year or under	6	5	2			
Two years	3	0	0			
Three years	1	2	0			
Four years	2	1	0			
Five years	1	0	0			
Six years	3	0	0			
Seven years	0	0	0			
Eight years	0	0	0			
Nine years	0	0	0			
Ten years	0	0	0			
Eleven years	1	0	0			
Twelve years	1	0	0			
	42	19	8			

Comparison of Results.				Garceau's List.	Bangs's List.	Facklam's List.
Nephrectomies and total resection of the ureter.	Abdominal method.			4	2	0
	G.	B.	F.			
Operative recoveries	4	2	0			
Operative deaths	0	0	0			
Percentage of operative deaths	0	0	0			
Deaths later	0	0	0			
No improvement	0	0	0			
Improved	0	0	0			
Recoveries (duration not given)	0	0	0			
One year or under	3	2	0			
Two years	0	0	0			
Three years	1	0	0			
	4	2	0			

Comparison of Results.				Garceau's List.	Bangs's List.	Facklam's List.
Lumbar nephrectomy and total resection of ureter.	Lumbar method.			8	2	0
	G.	B.	F.			
Operative recoveries	7	2	0			
Operative deaths	1	0	0			
Percentage of operative deaths	14.2	0	0			
Deaths later	0	0	0			
No improvement	0	0	0			
Improved	1	1	0			
Recoveries (duration not given)	2	0	0			
One year or under	2	0	0			
Two years	1	0	0			
Three years	0	1	0			
Four years	1	0	0			
	7	2	0			

Comparison of Results.				Garceau's List.	Bangs's List.	Facklam's List.
Lumbar nephrectomy and partial resection of ureter				9	1	0
	G.	B.	F.			
Operative recoveries	9	1	0			
Operative deaths	0	0	0			
Percentage of operative deaths	0	0	0			
Deaths later	1	0	0			
No improvement	0	0	0			
Improved	3	0	0			
Recoveries (duration not given)	2	1	0			
One year or under	3	0	0			
	9	1	0			

Comparison of Results.				Garceau's List.	Bangs's List.	Facklam's List.
Resections				3	1	2
	G.	B.	F.			
Operative recoveries	3	1	2			
Operative deaths	0	0	0			
Percentage of operative deaths	0	0	0			
Deaths later	0	0	1			
No improvement	0	0	0			
Improved	1	0	0			
Recoveries (duration not given)	1	0	0			
One year or under	0	1	1			
Two years	0	0	0			
Three years	1	0	0			
	3	1	2			

GENERAL SUMMARY (all operations).

Total number of cases	415
Total number of deaths	122
Immediate deaths (within one month)	74
Deaths later	48
Immediate mortality	17.8 per cent.
General mortality	29.4 per cent.
Total number of survivals	293
Time not stated	95
No improvement	3
Improved only and still affected by the disease	49
Recovered one year or under	88
Recovered two years	20
Recovered three years	11
Recovered four years	13
Recovered five years	3
Recovered six years	3
Recovered seven years	1
Recovered eight years	2
Recovered nine years	1
Recovered eleven years	2
Recovered twelve years	1
Recovered twenty-one years	1
	293
Total number of cures two years or over	58
Percentage of total cures two years or over	14 per cent.
Total number of cases well from within a few months of the operation, and therefore promising cases, and also cases of survivals two years or more	241
Percentage of promising cases	58 per cent.

CONCLUSIONS.

(1) Tuberculosis is rarely, if ever, primary in the kidney, and the original focus is in some other organ in more direct contact with the external air in the majority of cases.

(2) The presence of a primary focus of disease in the body, even if the disease has been thoroughly eradicated from the urinary tract, makes the ultimate prognosis in these cases doubtful at least.

(3) Such foci may remain permanently quiescent, but they may also become excited to activity by a generally low condition of the system, or by causes unknown to us.

(4) Patients should be told of the danger as regards the future for them, and they should lead lives of the greatest regularity, with strict attention to hygiene. A change of climate is very beneficial in these cases.

(5) Reported cures of long duration occur, but they have been few.

(6) Nephro-ureterectomy should be done in all cases in which the ureter is diseased, and the patient's condition allows of it. The bladder should be subsequently treated if diseased.

(7) An abandoned tuberculous ureter is an especial source of danger on account of the great liability of subsequent tuberculosis.

(8) Nephrotomy alone should be rejected except as a preliminary to a later nephrectomy.

(9) Resection is not justifiable, for we can never be sure that the portion removed is the only portion diseased.

VALVE FORMATION IN THE LOWER PORTION OF THE URETER.[1]

By WILLIAM E. MORGAN, M.D.,

OF CHICAGO.

H. P., aged twenty-one years, white, by trade a weaver, was referred to me in the latter part of June, 1901, and gave the following history:

No illness excepting diseases of childhood. No history of injury. No venereal disease of any character.

Present illness began four years ago, when patient was seized, while at work, with a sudden, severe pain in the left loin, radiating downward towards the bladder, accompanied with frequent desires to urinate, each time with small success. The pain was of a colicky character, caused a good deal of gastric disturbance, but no vomiting. Pain was intermittent, paroxysm would last for an hour, suddenly cease, and return again in a short time. This first attack confined him to bed about two weeks. After this the patient remained well, to all appearances, for two and one-half years, when he suffered another attack similar to the first; the attack lasting only a day or two, when his urine became stained with blood. This blood-stained urine continued for twelve days, but was unaccompanied by any pain. He was again free until June 1, 1901, when he had another attack, and following this the urine remained bloody until he came to see me.

Analysis of the urine at the time when he first came under my observation showed it free from fault, excepting a large quantity of fluid blood, which was thoroughly diffused without clot, passed without pain; patient free from any sign of infection, and no tubercle bacilli found.

I saw the patient at intervals of three or four days, and made frequent examinations of the urine. Twice during the month of

[1] Read before the Chicago Surgical Society, April 7, 1902.

July his urine was clear and without any pathological findings; these periods of freedom from blood lasted two or three days. With these two exceptions, his urine during the month of July continued to carry a large amount of blood.

August 1, the patient was taken with a severe attack of pain, and came to my office within an hour after the beginning of the attack. An examination at this time showed him to be suffering with an acute attack of ureteral colic; in every detail typical of acute obstruction. A sausage-shaped tumor, dull to percussion, fluctuating under high tension, and extending from the left renal region to low in the pelvis, was noted, occupying practically the left outer one-third of the abdominal area. His temperature was normal. The kidney itself could not be definitely outlined or palpated, owing to the great abdominal muscular tension. The patient was quieted with a hypodermic of morphine (half grain) and sent to his home, with instructions to apply hot fomentations and to use a rectal injection of a saturated solution of sulphate of magnesia. This was done for the purpose of emptying the colon, and also of relieving the vascular tension in the neighboring vessels. After emptying the bowel the patient felt completely relieved, and passed a large quantity of very bloody urine, and tumor disappeared. During the attack the urine was perfectly normal.

Bloody urine, though small in quantity, passed intermittently from this time until his entrance to Mercy Hospital, August 19, 1901.

Several days previous to his admission to the hospital, two skiagraphs were taken, under the suspicion that the patient was suffering from ureteral calculus. Both of these skiagraphs were preceded by colonic flushings, in order to make any stone throw a shadow. Skiagraphs of the genito-urinary apparatus are worthless without first emptying the colon, owing to the fact that colonic fæces contain enough mineral matter to frequently obstruct the rays, and thus cause the appearance of stone when there is none. Both of these skiagraphs proved negative, the skiagraphic renal and ureteral fields being free from definite shadow. Notwithstanding this, my diagnosis was practically "ureteral calculus," thinking, perhaps, a small stone was lodged somewhere in the ureter, perhaps in its lower portion, and overshadowed by bone.

On admission to the hospital, his urinalysis, August 19, 1901, showed 900 cubic centimetres for quantity per day, practically normal in specific gravity and urea, with a bare trace of albumen and some microscopic blood. No casts. No sugar. No calculi. No tubercle bacilli.

The patient was put under preparation in the usual manner for exploratory nephrotomy.

The next day, under ether anæsthesia, and with the assistance of Drs. Tarnowsky and Sampsell, an oblique lumbar incision was made over the left kidney, and without difficulty the kidney drawn into the wound. The kidney was normal in consistence, without gross pathological findings, save in size, being at least one-third larger in all diameters than normal. Microscopic examination, subsequently made, showed the tubules dilated and the renal secreting epithelia in spots separated from their underlying beds,—this being a not unusual thing; in fact, the common sequence of back pressure of the urinary current. Some degeneration of these same cells was noted in several of the specimens.

The pelvis of the kidney was found symmetrically enlarged, proportional in every respect to the increased size of the kidney, but not sacculated; thicker than normal, and without pathological changes. Palpation and needling of the kidney in all its parts was negative in result.

Not having found anything to explain the symptomatology, the incision was extended to one and a half inches below the crest of the ileum, and on lifting the peritoneum inward the ureter rolled into view, and at first sight gave the impression that we were dealing with the colon; its size being about one and one-quarter inches in diameter, and symmetrical, throughout all parts visible and palpable.

Not having found the point of obstruction, exploration of the ureter internally became the next step; the ureter being opened first about one and one-half inches below the pelvic narrowing, and a uterine sound being passed first upward to the kidney, and then downward throughout the length of the ureter, until it seemed to strike the end of a blind pouch close to the bladder. No foreign body was found. The ureter was a trifle over one-eighth of an inch thick; the mucous membrane, which was rendered visible by my incision, appeared perfectly normal in every respect; the muscular and the vascular layers were

normal, save in thickness, and there was no sign either within or without the duct which would indicate inflammatory action. In size throughout the ureter would easily admit two fingers, and this symmetrical enlargement retained its cylindrical shape almost perfectly, even after the ureter had been opened and its contents had escaped. The escaped fluid (two ounces in quantity) showed itself, under analysis, to be practically normal urine, with the exception of a little microscopic blood.

As the patient's condition, even after these two hours of operating, was still good, I decided to explore farther, and therefore made a longitudinal opening into the ureter at its lowermost exposed portion, namely, one inch below the anterior superior spine. Now, with Kelly's specula, the lower three inches of the ureter were examined with head mirror, and an apparently blind pouch without any visible opening, and without any pathological appearances save the increased size, was seen; and, although numerous flexible and non-flexible probes were tried in every portion of this pouch, no opening was found which could lead into the bladder.

Signs of shock coming on, and the operation having lasted three hours, it was thought best to postpone further work till a future date. I therefore closed the lower opening into the ureter with fine silk continuous suture, not allowing the suture to enter the mucous coat, and two tubes were inserted,—one, in the upper opening of the ureter for draining the kidney, and the other to the suture wound in the lower portion of the ureter; the rest of the incision was closed with interrupted silkworm-gut, a small amount of gauze packing being used in the deep parts. The patient was then sent to bed in a fair condition, and siphonage applied to the upper tube.

On the day subsequent to the operation the temperature rose as high as 103° F., and the pulse to 130. Patient suffered considerable pain in the wound, but no bladder irritation.

After cleaning out the colon thoroughly by local means and with the assistance of some strychnine and codeine, the patient's temperature and pulse dropped the next day, and the condition from then to September 11, 1901, continued to improve; the temperature remaining practically normal; the pulse good; the urine fair in quantity and quality; drainage from the field of operation being excellent, and with practically no sepsis.

On September 11 the patient began a siege of renal suppression, the urine from the right as well as from the left kidney showing all the evidences of acute nephritis, namely, albumen in large quantity; hyaline and granular casts; low percentage of urea; low specific gravity; and the quantity reduced to about 500 cubic centimetres per day; the left kidney (the operated kidney) doing the most work. This attack continued for about a week, when, by frequent use of normal salt solution and the free administration of calomel, digitalis, and strychnine, he began to improve. During these attacks blood examination showed marked leucocytosis, and the inference was that the nephritis was due to infection. Frequent investigations of the urine showed a similar condition in the right kidney to that in the left kidney, excepting that no pus was found in the urine secreted by the right kidney, while it was present in considerable amount in the urine coming from the left kidney.

After gaining a little strength, the patient was allowed to go about, and from this time he made very rapid improvement in general health. The urine became good in quantity, good in urea, good in specific gravity; that from the right kidney being practically normal, and that from the left kidney containing only a small quantity of albumen and some few pus-corpuscles.

The abdominal wound quickly healed, though not without some slight infection in the skin.

By December 7, 1901, he had so far improved as to permit of further operation, and, after the usual preparation, a suprapubic cystotomy was made sufficient to allow of thorough exploration of the interior of the bladder, which was found to be practically normal. The right ureter was found free; soft ureteral sounds being passed high up in the ureter without obstruction. The left ureteral opening into the bladder was slightly overlapped by a duplication of the mucous membrane, but not sufficient to constitute an obstruction. Flexible and silver sounds found easy entrance into the ureter up to the size of an ordinary uterine sound, but all reached an obstruction after passing into the ureter a distance of one and three-quarters inches. A sound passed from the lumbar opening to the end of the blind pouch below could not be touched by any kind of manipulation of the sound passed into the ureter from the vesical opening. The vesical sound seemed not to strike a blind pouch, but to be rather pinched at its end.

Owing to the fact that the bladder remained practically dry during this operation, lasting an hour, I became frightened lest another acute suppression was coming on from the ether, and therefore ceased further operating. No urine was passed into the bladder through either ureter during the operation, and almost no flow came from the lumbar opening. These two factors were evidences to my mind that the ether was suppressing the urine. I therefore desisted from further exploration at this sitting. Suprapubic drainage was applied, and the remainder of the suprapubic wound was closed in the usual manner.

Subsequent history shows that the fears of urinary suppression were not unfounded, for the urine, although not markedly altered in quality, became reduced to a very small amount, and for several days after the operation the patient suffered with rather severe symptoms of uræmia. This, however, all passed away in the course of ten days, and from then on he again made rapid improvement.

By these two operations we had now reached at least a definable diagnosis as to the locality of the obstruction. We had also ascertained that ether was borne poorly by his kidneys; that the effect of the ether was bilateral; that, notwithstanding the improbability of removing the obstruction, he could ill afford to lose the left kidney, for this organ was doing practically two-thirds of the work.

By January 15, 1902, five weeks after this second operation, he was in such condition as to lead me to make one more attempt to relieve his obstruction; and after the usual preparation an incision was made, four inches long, from the lower end of the previous iliolumbar wound, directly over the line for ligation of the iliac vessels on the left side; this incision involving the internal inguinal ring and thus lying to the inner side of the cord, passing through the abdominal muscles and reaching into the transversalis fascia. Carefully separating the parietal peritoneum from the vessels and from the pelvic wall, the ureter was with difficulty finally exposed to the bladder. I experienced the greatest difficulty here in caring for the cord, for it was necessary, owing to the depth of the wound, to use long and broad retractors, and these were continually threatening to become entangled with the cord, and thus injure its vessels. However, by the use of a flat sponge, carefully laid down over the iliac vessels and the

cord, I was able to retract with more confidence. The ureter clung, as it usually does, to the under side of the peritoneum, so that, as the peritoneum was retracted inward and pulled upward, the ureter went with it, easily lifting off from the iliac vessels.

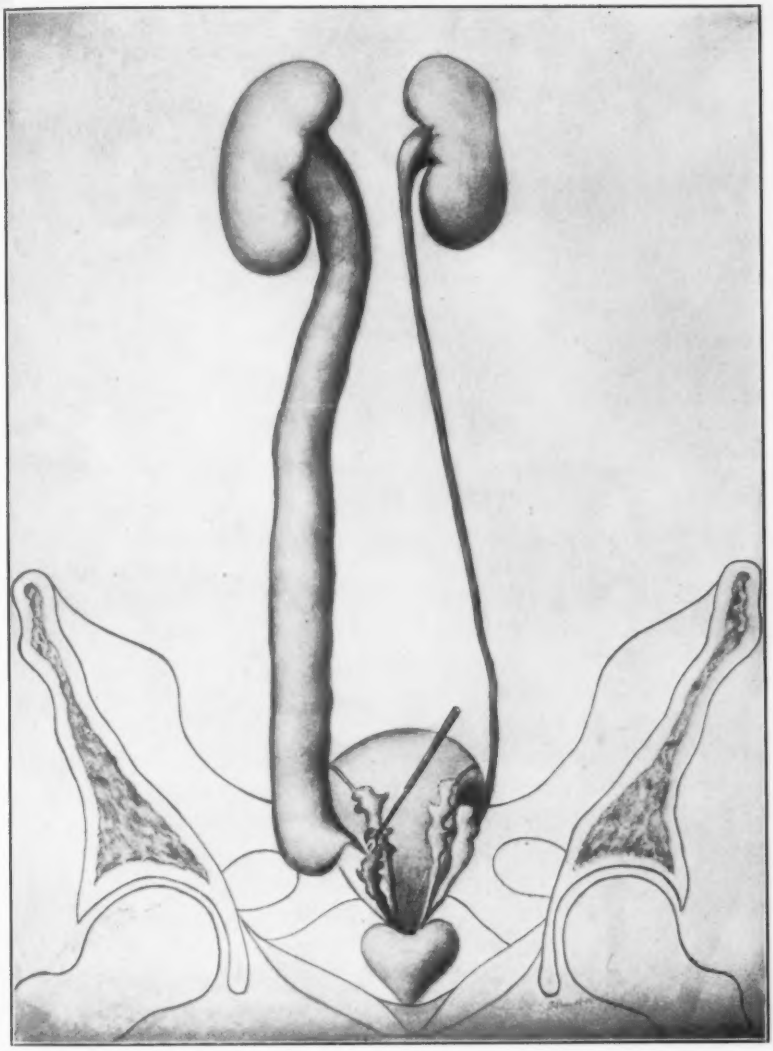
The dilated ureter was now found to extend to, and even a little beyond and behind, the upper limits of the seminal vesicle. The dilatation, as will be seen in the illustration, although symmetrical, at the same time pouched almost entirely to the left.

An opening into the ureter was now made within one and one-half inches of the pouched end. I feared to open the ureter lower than this point because of lack of confidence in future sufficient drainage, as the post-peritoneal tissue here is so delicate and easily separated from its surroundings and lies in such a basin that infiltration can easily occur, and drainage, except by the perineal route, which is exceedingly difficult, would be impracticable.

The Kelly specula were now used to explore this pouch. Every part of the pouch was thoroughly visible, and yet nowhere could I find an opening which would lead into the bladder, notwithstanding the fact that a ureter of practically normal size was externally visible below the pouch; the tip of the seminal vesicle having been carefully lifted from the flat surface sufficiently to demonstrate the presence of such ureter passing into the bladder wall in the usual oblique manner.

The patient was in good condition, and I determined to ascertain if there was an opening into this pouch, and if not, to make a ureteral anastomosis or a vesico-ureteral anastomosis; so I proceeded at once to make, again, a suprapubic opening into the bladder, for exploration of ureter in both directions. After considerable intravesical search I found the ureteral opening, and was able to pass a very small probe into the ureter, and after much difficult manipulation it found its way through a small opening in the upper internal segment of this pouch, this opening being obstructed by a visible pouch or fold or valve of mucous membrane which acted in exactly the same manner as a flap-valve.

Now, an inflexible uterine sound was passed from the lumbar opening down through the full length of the ureter and to the end of the blind pouch, and manipulations were made with this sound and with the sound passed upward through the ureter *via* the



Showing dilated ureter pouching almost entirely to the left.

bladder route, in an effort to make the two ends touch each other, and discover, if possible, why at our previous operation we were unable to get the click of the two sounds. The lumbar sound was found to be quite freely movable in either direction, but the lower sound was hindered in the anteroposterior direction, so that by no manner of motions or alterations in the position of the patient could the two sounds be brought into contact. The cause of the obstruction was apparently a reduplicated transverse fold of mucous membrane, with also a tough network of connective-tissue bands surrounding and pinching the ureter at the point of the fold. These became apparent while separating the seminal vesicle from the ureter. There were several firm bands of connective tissue, which required the use of scissors before they would yield in separating the seminal vesicle from the duct. After this separation, the pinched ureter immediately became free and the vesico-ureteral sound was rendered freely movable up and down.

The patient having been under an anæsthetic for two hours and the bladder this time, as before, remaining dry, I hurried through the remaining steps of the operation without making it as complete as I desired. By dilating the ureter pouch to an extent sufficient to allow the easy use of a knife, I now cut the mucous fold in two, in the longitudinal diameter of the ureter. I could now pass a No. 6 gum catheter from the lumbar opening down through the full length of the ureter into the bladder, and out through the suprapubic opening, with ease and freedom. I found no difficulty in drawing the catheter back and forth from bladder to lumbar opening without binding and without tension. I did not follow, as I desired to do, the Fenger method of suturing the incision of the mucous fold end to end, because of the great depth of the wound and because of the necessity of closing the patient as quickly as possible.

Suprapubic drainage was again supplied with siphonage. The exploratory wound in the ureter was closed, as before, with continuous silk suture; the rubber tube being inserted deep into the pelvis and out just beyond the crest of the ilium; this was used for supplying drainage in case of urinary leakage. The gum catheter was left *in situ* and fastened by a string, because I noticed that, shortly after a similar use of a dilating catheter, vermicular motions in the ureter were constantly drawing the catheter downward, and I feared to lose its upper end.

For two or three days the patient suffered considerable pain in the left testicle and cord, though no swelling nor inflammatory action could be found. No urinary suppression followed this operation, and the patient rapidly made strides towards good health.

The gum catheter was daily moved up and down through the ureter in order to prevent, if possible, the accumulation of phosphatic deposits, and thus perhaps give rise to future accumulations of a calculous nature.

Incidental to this, I would mention that the French or English silk catheter or lacquered sounds are inapplicable to continuous ureteral dilatation. The shellac or varnish on such catheters within a day or two becomes loosened, swells, and blisters, and finally cracks off; and if such a sound be left for a week or ten days, on its withdrawal it will be found to be rough, bare of coating in spots, and wherever bare some phosphatic deposits are apt to accumulate. Then, again, chips of lacquer or varnish are just so many foreign bodies left in the ureter for future calculi.

The soft rubber catheter or sound remained smooth and uncoated. At the end of fourteen days, this soft rubber catheter was withdrawn, the pelvic tube removed, and the suprapubic tube also removed, and then all the lower wounds were allowed to heal, which they did uninterruptedly and without manifest infection. No leakage occurred.

On March 19, 1902, the lumbar drain was removed, and the patient immediately began to pass the urine from his left kidney into the bladder. Since that time, with the exception of slight lumbar leakage (not more than one ounce in twenty-four hours), all of his urine passes by the normal route, the urine at this date (March 27) being as follows:

Ten hundred and fifty cubic centimetres in twenty-four hours; acid in reaction; specific gravity, 1011; urea, 1.1 per cent.; chlorides and phosphates normal in quantity; sulphates slightly reduced; albumen present in very small amount; no casts; some pus and motile ferments; no epithelial *débris;* no blood; some motile bacteria.

The lumbar wound fast closing, and the patient in good general condition.

This case may serve to emphasize the fact that there is no portion of the ureter which is inoperable; that a kidney doing a fair amount of work and not in a destructive pathological condition, should be saved, even though it may be necessary to operate several times and with long sittings and with the utmost patience. Again, it is a confirmation of the investigations already made and so fully explained by Fenger in his researches on the ureter.

As I look back over the field that has been covered in this case, in an effort to discover any easier and safer method of diagnosing the character and the location of a ureteral obstruction, I cannot find in the literature recording the experiences of others anything which seems to me could have lessened the amount of operating. I believe no stone was left unturned in means of diagnosis. A papilloma of the ureter, which usually occurs either at the bladder opening or a short distance from the bladder, can give rise to every symptom from which this patient suffered; and after excluding stone, both by the skiagraph and by the exploration, I feared that a papilloma or a polypus was the next most probable obstruction; but such was not the case. The obstruction was apparently due to some local inflammatory action which had taken place very early in life, and which had resulted in some small adhesive bands surrounding the ureter at its location just under cover of the tip of the seminal vesicle and binding the vesicle to the ureter and to the bladder. The fold of mucous membrane I believe to have been a subsequent development, and due rather to an hypertrophy than to a congenital formation. In other words, the inflammatory bands impeded, but did not totally obstruct, the flow of urine for many years. This led to a gradual pouch formation, which finally became of such a size as to make a sharp angular deformity at the place of most dense adhesion, and this angular deformity led to a valvular mucous fold, which intermittently completely shut off the ureteral current.

The hæmorrhage, I believe, was due to sudden relief from pressure on the escape of urine when it overcame the valve, for we know that accumulations of urine in the ureter or in

the pelvis of the kidney for a considerable length of time, when allowed a sudden escape, will lead to hæmorrhage from the renal vessels which have been kept for several hours or days under high tension, and have consequently weak and thin walls. In the drainage of abscess under high tension, it is usual for the pus to be followed by a very free escape of blood; and I look upon the escape of blood in this case to be due to practically the same thing. I am still more confirmed in this opinion because, since the first operation, the patient has never passed any bloody urine excepting what came during his attack of nephritis, and that was in very small amount.

The greatest risks incurred were those incident to long operating (ether suppression) and ureteral and ascending secondary renal infection from the prolonged lumbar drainage. These two factors will always be my future bugbears, for they both occurred to an alarming degree, notwithstanding great care in dressings, diet, and medication, and watchfulness on the part of my nurses and assistants. I am thoroughly convinced, after my experience with this case, that this route is an ideal one for reaching and dealing with the pelvic ureter, the seminal vesicle, the pelvic portion of the spermatic cord, and a large portion of one-half of the subperitoneal bladder in the male, as all of these structures were rendered clearly visible, and were palpable to two fingers of one hand, or even to the index-fingers of both hands. Anatomically, I must note that great care must be had for the peritoneum, as it is here extremely thin and consequently torn easily; that care must be had to keep the peritoneum clearly in view so soon as it appears in the wound, else one may become lost in the iliac fascia instead of keeping within the subserosa; that the spermatic cord must be protected from bruising, and that the ureter, unless bound to other surroundings by pathological products, lifts up *with* peritoneum.

It perhaps is unnecessary to more than mention that the great size of the iliac vessels is sufficient to warn the operator against their injury.

EXCISION OF THE LUMBAR LYMPHATIC NODES AND SPERMATIC VEIN IN MALIGNANT DISEASE OF THE TESTICLE.[1]

A CONTRIBUTION FROM THE SURGICAL LABORATORY OF THE PHILADELPHIA POLYCLINIC.

BY JOHN B. ROBERTS, M.D.,

OF PHILADELPHIA.

THERE will probably be little dissent from the proposition that operations for malignant disease should usually include removal of the adjacent lymph nodes. In mammary carcinoma, surgeons remove not only the entire mammary gland and its surroundings, but also the axillary lymph nodes and fat. Some extirpate also the nodes above and below the clavicle. The lymph nodes are similarly excised in malignant tumors of the lower lip, at the time the growth is extirpated. An operation for malignant disease can scarcely be called complete unless this precaution is taken. To permit the lymphatic glands to remain until affected by secondary involvement is a grave error of judgment.

It is usually wise to remove the lymphatic glands or nodes before the tumor is attacked, because it is possible that the handling of the tumor, necessitated by the operative manœuvres, may press cells from the focus of the disease into the lymph current. As soon as possible after a diagnosis, or probable diagnosis, of malignant tumor is made, the patient should submit to operation. This should begin with removal of the nearest chain of lymph nodes and be immediately followed by radical extirpation of the growth and its surroundings.

The combination of an early and a radical operative attack will give the best opportunity for the patient to escape

[1] Read by title before the American Surgical Association, June 3, 1902.

death. Fatal results may occasionally follow such surgical methods, but the risk must be taken in the struggle with a relentless enemy. At the incipiency of malignant disease, the process is local and extirpation therefore possible. It is usually better to do no operation than one that is evidently incomplete.

These views have led me to advocate and to employ more radical procedures in malignant disease of the testicle than those which have usually been adopted. The testicle is liable to become the seat of carcinoma and sarcoma. The former gives rise to secondary involvement by the lymph current; the latter, by the venous blood current. The testicle is suspended from the trunk in a manner that makes it, in a way, a pendulous extracorporal organ. Hence, it seems as if malignant disease there ought to be more successfully combated by early operative intervention than in any other region. We know that early and radical operations in malignant tumors of the breast are successful, in many instances, in preventing local return and secondary metastatic involvement. The anatomical situation of the testicle would seem to promise better results, were the same thoroughness employed in operative attack.

The blood current from the testicle runs in the spermatic veins; the lymph current in the corresponding lymph vessels. Both kinds of vessels enter the abdomen, as is well known, by the spermatic cord. The right spermatic vein then ascends and empties into the vena cava at about the level of the upper edge of the third lumbar vertebra; the left, into the left renal vein at about the level of the lower edge of the second lumbar vertebra. The lymph vessels reach no lymph nodes until they pass into the lumbar nodes.

It is desirable to know with accuracy into which of the lumbar nodes the spermatic lymphatics first empty. It is admitted that they seldom enter a node until they reach the lumbar lymphatic plexus. Whether they empty first into the lower or upper lumbar nodes, and whether the nodes in the middle line, lying over the aorta, or those at the sides of that vessel are the first to receive the lymph from the testicle and its deep coverings are questions of importance.

That the lymphatic drainage of the scrotum and superficial parts of the genital organs goes to the inguinal glands is well established. This fact makes it wise to extirpate the inguinal nodes in testicular carcinoma and sarcoma.

The writers on anatomy are not very definite, and are not quite in accord as to the point under discussion. Gray [1] gives an illustration of the lymphatics from the testicle emptying into the lateral lumbar glands in front of the psoas muscle. Leidy [2] says that the half dozen or more spermatic trunks are remarkable for their great proportionate size and terminate in the upper lumbar glands. This statement accords pretty well with the figure given in Gray. The description given by Macalister [3] is to the effect that the lumbar lymphatic plexus is very large and loose meshed, and lies at each side of the aorta and in front of the psoas muscles, and that the vessels are united across the aorta by a median aortic lymphatic plexus with about six glands in its course. The vessels of the lumbar plexus begin, according to Macalister, below by receiving the vessels of the common iliac and sacral plexuses. Where these join there are usually four or five glands, the efferent vessels of which receive the spermatic lymphatics from the testis and its deep coverings.

Gerrish [4] shows in a diagram the lymph vessels from the testicle running to the lowest one of the median lumbar glands. There is a communicating branch from this node to the median node immediately above it and one to the lowest lateral lumbar node. This diagrammatic sketch would scarcely be mentioned in this discussion were it not that Dr. Gerrish has been particularly interested in studying the course and distribution of lymphatic vessels. I am, therefore, somewhat inclined to accept this schematic illustration as evidence that he believes that the lymph current from the testicles flows directly into the lower part of the median chain of glands as a rule, and not directly into the lateral or into the upper glands. Dr. Gerrish divides the lumbar lymphatic nodes into the median, situated close to the abdominal aorta, and the lateral, lying in the spaces between the transverse processes of the lumbar vertebræ. He

says that the supply of lymph to the median nodes comes from the body of the uterus, the ovaries and the Fallopian tubes, the testicles, the kidneys, the ureters, the diaphragm, the suprarenal bodies, and the external iliac, internal iliac, sacral and lateral lumbar nodes; and that the trunk by which they discharge into the receptaculum is joined by the efferents of the lower part of the descending and the whole of the sigmoid colon. He says that the afferents of the lateral lumbar nodes come from the lower part of the spinal canal and the dorsal and lateral portions of the abdominal walls, and that their efferents run to the median lumbar nodes and the receptaculum. His diagram shows five median lumbar and seven lateral lumbar nodes.

Testut [5] divides the abdominal nodes into lumbar or lateral, pre-aortic or median, and visceral. He describes the lateral or lumbar as lying on the sides of the vertebral column and aorta and vena cava, forming an uninterrupted chain, which extends from the middle portion of the primitive iliac artery to the first lumbar vertebra. He says that Sappey counts twenty to thirty on each side. Testut says that the median, which he also calls the pre-aortic or supra-aortic nodes, lie in front of the aorta and inferior cava, with some of them insinuating themselves between these vessels. He describes them as an uninterrupted chain extending from the bifurcation of the aorta to the upper border of the pancreas. His description of the spermatic lymphatics is that they arise from the testis, epididymis and vas deferens, and unite in seven or eight large trunks which follow the course of the spermatic artery and vein, being part of the spermatic cord, and empty into the lumbar nodes at the level of the kidneys. This description seems to correspond with that of Leidy and Gray rather than with that which I have mentioned as the possible opinion of Gerrish. It seems to be also in accord with probabilities, for the spermatic veins and arteries communicate with the general circulation just about the level of the kidneys.

The accurate study of the lymphatic glands made by Cecil H. Leaf [6] contains an excellent colored illustration of the distribution of the lymphatic glands about the abdominal aorta.

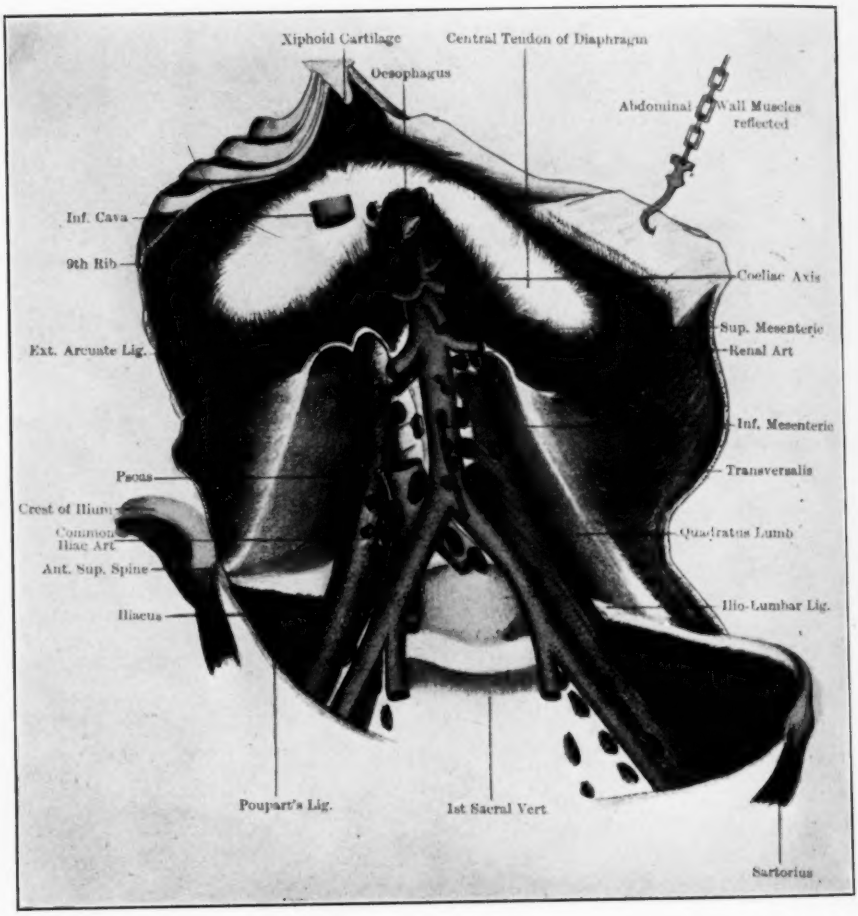


FIG. 1.—Dissection showing lymph nodes near abdominal aorta. (From Leaf.)

This authority, however, makes no attempt to describe the vessels communicating with these glands or nodes. He says that the glands in relation to the abdominal aorta may be divided into a mesial and a lateral set. The lateral set he calls the lateral aortic or lumbar. The lower ones of the mesial set he calls the inferior mesenteric. He says that four or more small glands lie over the aorta and partially surround the inferior mesenteric artery. The figure is understood to be illustrative of the mean distribution of the glands, for the author admits that the distribution of the lymphatic nodes in the various parts of the body is not constant. He says that the lateral aortic, or lumbar as he calls them, are seven or more in number, and are situated on both sides of the aorta upon the vertebræ. On the right side the lateral group lie, according to Leaf, for the most part, entirely under cover of the inferior cava, though three or more are often found lying on its anterior surface. One of the glands on the front of the psoas muscle is stated to be often seen to lie in close relation to the spermatic vein shortly before it terminates in the vena cava or left renal vein. This is probably an important one in our study.

In a painstaking study of the manner in which metastasis occurs from malignant tumors of the testicle, Most [7] made injections of the lymphatic vessels. His diagram of the result shows the lymphatic vessels from the testicles emptying into lymphatic nodes in front of and alongside of the aorta at the level of the kidneys. There are, however, lower nodes, in the vicinity of the bifurcation of the aorta, and other nodes behind the aorta and vena cava, which also received the injected pigment. It is very evident that the communication between the nodes is quite free. The general metastasis occurring so often from testicular carcinoma is easily explained by the anatomical course of the lymph current, which so easily reaches the receptaculum chyli and from it the general blood current.

Dr. Most says that there is no barrier between the testicle and the thoracic duct except the lumbar nodes, and that this is an imperfect guard. He says that the first nodes reached by the lymph flow from the right testicle lie on the vena cava,

and that the first ones reached by the current from the left testicle lie near the aorta. These primary nodes lie at about the level of the lower pole of the kidney. The nodes can be shown to communicate rather freely with each other by means

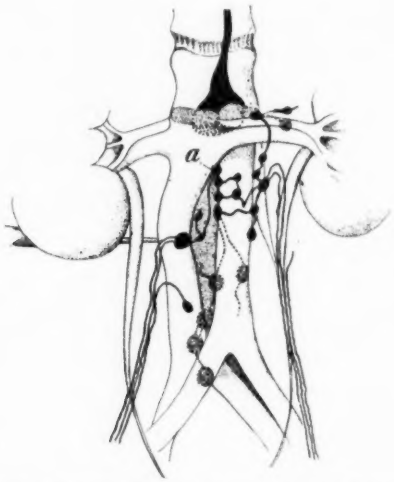


FIG. 2.—Injection of the retroperitoneal lymph vessels and nodes connected with the testicles. The nodes, indicated by black dots, are covered by overlying structures, and are not visible until these structures have been lifted up. The vena cava has been drawn a little to the right. The figure is a combination of two experimental injections,—one from the right and one from the left testicle. A node at *a* received the coloring matter from both testicles. The direct communication with the receptaculum chyli is seen on both sides. (From Most.)

of anastomosing vessels, and Most was able to send an injecting fluid from the testicle all the way up to the entrance of the thoracic duct into the subclavian vein.

The anatomical arrangement suggests the proper surgical steps for curing, by extirpation, malignant disease of the testicle.

The lymph coming from the testis empties, as has been shown, into nodes in front of, and alongside of, the aorta and vena cava. About the level of the lower pole of the kidney seems to be the usual situation of the first nodes reached by the ascending lymph stream. Those as far down as the bifurcation

of the aorta have, however, rather free communication with the nodes thus first reached. In operating to excise the nodes likely to show metastatic involvement from malignant growths in the testicle, it is probably wise to remove all of them that are accessible, from the level of the aortic bifurcation up to the level of the renal veins.

The certainty or probability of malignancy being present should determine immediate operation. The first step should be to open the abdomen in the middle line, remove all the accessible lymph nodes in the vicinity of the aortic bifurcation, excise a couple of inches of the spermatic vein of the diseased side, and close the abdomen. The second step should be the removal of the inguinal lymph nodes, the spermatic cord from the internal ring downward, the diseased testicle, and the lateral half of the scrotum. By operating in this manner and in this succession, the filter-like nodes and the channels, by which the abnormal cells or causative microorganisms enter the system, are separated from the patient early, the danger from manipulation of the testicle pressing these morbific agents into the circulation is reduced to a minimum, and the probability of both local and metastatic return is largely decreased.

If the exact nature of the pathological process is known, it may be sufficient to excise the lumbar nodes and leave the spermatic vein untouched, in carcinoma; or to resect the vein and leave the lymph nodes undisturbed, in sarcoma. When no such exact knowledge exists, it is probably wise to operate upon both nodes and vein, for the operative risk is very little increased thereby. It would be possible in some instances, perhaps, to delay operation a few days until a microscopic examination be made of a fragment of the tumor, taken for the purpose from the testicle.

If it is true, as Leaf's dissections[8] seem to show, that small lymph vessels and veins freely communicate, both nodes and veins should probably be excised in all cases, whether the disease be carcinoma or sarcoma.

The abdominal incision should be median, and extend

about two inches above and about two inches below the navel. The small intestines should be pushed to the right side of the patient and the posterior layer of the peritoneum opened over the aortic bifurcation. Care must be taken to avoid injuring the inferior mesenteric artery, alongside of which will be seen lymph nodes. These nodes are not to be disturbed, because they receive lymph from the intestines and not from the testicles. The nodes to be excised lie upon and at the sides of the aorta from its bifurcation up to the level of the renal vein. They vary in size, being often not larger than a grain of wheat, and may be embedded in fatty tissue. The safest course probably is to remove all the adipose tissue found in front of the aorta and cava and at the sides of these great blood-vessels. It is perhaps wise to excise the glands on both sides of the median line though only one testicle be diseased.

Resection of the spermatic vein should be restricted to the side corresponding to that of the malignant tumor. I have not performed this operation, and feel that there may be some difficulty in its application to the living subject. Studies on the cadaver have, however, made me believe the phlebectomy possible.

The two veins ascend in the respective spermatic cords and lie about one inch to the right and left of the middle line of the aorta, at the level of its bifurcation. They are situated rather deep in the hollow alongside of the spine. As they ascend, they perhaps come a little nearer to the aorta. The pulsation of the spermatic artery, which accompanies the vein for some distance, may possibly aid in the recognition of the latter vessel. The ureter lies more deeply than the spermatic vein and a little farther from the middle line. It is thicker and more resistant to the fingers than the vein; but, as it is practically parallel to the latter, it may be mistaken for it. The operator should not forget the possible existence of two ureters on one side.

Pressure on the supposed vein at the upper part of the abdomen will cause it to become distended with blood, and aid in clearing up doubt as to its identity. There is a vein running almost parallel with the left spermatic vein, which

is smaller and more superficial than the latter. As it empties into a large vein running more or less transversely, it might readily be mistaken for the left spermatic emptying into the renal vein. This vein is the inferior mesenteric coming from the intestines and opening into the splenic vein. It must be avoided, because injury to it might be disastrous in its later consequences.

When the spermatic vein has been recognized with certainty, it should be ligated with two catgut ligatures placed about two inches apart. The intervening portion of the vein should then be excised.

A Case of Excision of the Lumbar Lymph Nodes in Recurrent Carcinoma of the Testis and Spermatic Cord.

The present anatomico-clinical study was incited by an excision of the lumbar nodes, in October, 1901, in a case of recurrent carcinoma of the testicle and spermatic cord.

A gentleman, sixty-eight years of age, had noticed an enlargement of the left testicle in May, 1900. There had been no known traumatism. The condition was recognized as malignant by Dr. C. M. B. Cornell, of Ontario, who in July of that year removed the testicle and vaginal tunic. In July of the following year (1901) excision of a recurrent tumor at the site of the original trouble and of markedly enlarged inguinal lymph nodes was done. The cord was divided high up, where it showed no macroscopic evidence of disease; and all the lymph nodes discoverable above and below Poupart's ligament were extirpated. The pathological report was to the effect that the growth was squamous cell carcinoma.

Two months later (September, 1901) a small nodule appeared at what seemed to be the end of the cord. The patient consulted me, at the instance of Dr. Cornell, in October, 1901.

The evident virulence of the malignant disease caused me to undertake a more radical operation than has, so far as I know, been done to avert the fatal issue in such testicular growths. I removed the lumbar lymph nodes, into which the lymph vessels from the testicle and spermatic cord empty, and made a wide excision of the small inguinal tumor. The known tendency of testicular tumors to invade by metastasis these nodes and the general system made this operation justifiable.

It was on October 16, 1901, that I made a median incision from the umbilicus to within an inch of the pubes, but found that the thickness of the abdominal wall was so great that this did not give sufficient opening. I accordingly divided the skin and the left rectus muscle by an incision running towards the anterior superior spine of the left ilium. Before cutting the muscle, I inserted heavy sutures into it, above and below the proposed incision, to aid in controlling the contracted ends, when closing the abdominal wound.

The peritoneum in front of the aorta was divided, and the fatty tissue, lying over that vessel at its bifurcation, removed. In this fat I recognized several small lymphatic nodes, which were of normal appearance to naked-eye examination. A good deal of time was consumed in excising with scalpel and scissors this pre-aortic cellulo-adipose tissue. The seat of operation was deep, for the patient was of large frame and very fat. No lymph nodes were recognizable through the overlying tissues, for they were of normal size and enveloped in the fatty tissue. As I removed successive pieces of tissue, I felt and demonstrated the enclosed nodes. I desisted when the front of the aorta was denuded from its bifurcation to a point about two inches higher up.

The growth in the groin was then excised, with a portion of overlying skin and a couple of inguinal lymph nodes, and the incisions were carefully closed with sutures.

After the operation the patient showed signs pointing to intestinal obstruction, but the tympany was finally relieved and bowel movements were obtained by enemas and saline laxatives. At the end of a week the abdomen was flat, and my uneasiness on that score was relieved. About this time suppuration in the median wound occurred, and finally required the sutures in the skin and superficial fascia to be removed for nearly its entire length. A fæcal fistula occurred about two weeks later. Attempts were made to close this by a Murphy button, which was extruded from the wound; and later by circular enterorrhaphy.

Death occurred on December 8, two days after the last operation, and was evidently from peritonitis. The wound in the groin had healed by first intention; but a few weeks before death a small tumor appeared in the region of the scar. This was evidently a local recurrence of the malignant disease.

I was not able to determine the cause of the temporary intes-

tinal obstruction or of the fæcal fistula. They were incidents not necessarily associated with the excision of the lymph nodes.

The report of the pathological examination of the tumor of the groin, made by Dr. B. M. Randolph, Jr., Director of the Polyclinic Laboratory, is as follows: "Supporting structure of adult connective tissue, more or less dense, and honeycombed with alveolar spaces. In this connective tissue are a moderate number of blood-vessels with walls of normal or slightly increased thickness. Alveoli are of various sizes and shapes,—spherical, ovoid, and irregularly fusiform. They are more or less compactly filled with cells of various shapes and sizes of the epithelial type, with large oval nuclei, which stain with varying degrees of intensity, and present one and frequently two prominent nuclei."

"The pathological findings in the four excised lumbar lymph nodes prove that the malignant process had just reached those structures by metastasis. The section from lumbar lymph node No. 1 showed "connective-tissue capsule sending prolongations into substances of organ, forming alveoli. These alveoli are filled with round mononucleated cells of uniform size (lymphocytes) giving the ordinary appearance of lymphatic gland. Scattered among these lymphocytes are a very few flat cells of irregular polygonal shape with oval nuclei."

The section from lumbar lymph node No. 2 presented the same appearance as the section from No. 1.

The sections from the lumbar lymph nodes Nos. 3 and 4 "show no departure from normal histology of lymph glands."

"Diagnosis. Carcinoma. Beginning Metastasis of Lumbar Lymph Nodes."

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REPORT OF A CASE OF GUNSHOT WOUND OF THE THORAX INVOLVING THE HEART.[1]

By LEVI J. HAMMOND, M.D.,

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On the twenty-sixth day of the third month of the present year, J. F., a laborer, fifty-one years of age, and a Pole by birth, was brought to the hospital by a patrol, seven and a half hours after having received a gunshot wound of the thorax, which was said to have been received accidentally.

I saw the patient about one hour after his admission, at which time he was satisfactorily recovering from shock, temperature being 98° F.; pulse, 96; respirations, 30. Objectively, the man showed nothing remarkable so far as expression was concerned, excepting some pallor noted about the lips and some blanching of the conjunctival surface. He was able to answer such questions as he could be made to understand; the inability, however, to speak his language, as well as the marked defect in his hearing, made anything like a satisfactory history from him impossible.

Inspection at this time showed the wound of entrance of the bullet to be about one and a half inches above the ensiform cartilage, and about the same number of inches to the left of the sternum. The bullet had evidently glanced before penetrating the thorax, as shown by the burned condition of the tissues for fully one-quarter of an inch. There was an immense hæmatoma extending from the posterior axillary line to the nipple-line anteriorly, and from the axilla above to the diaphragm below. Fluid was distinctly felt in the soft tissues external to the ribs.

The patient was reacting so favorably to the usual methods employed in the treatment of shock that there seemed no reason for alarm for fear of consecutive hæmorrhage after the lapse of this number of hours. The treatment, consequently, consisted in placing the patient absolutely at rest in the recumbent position,

[1] Read before the Philadelphia County Medical Society, May 28, 1902.

first having rendered the entire thorax perfectly aseptic, dressing the wound with aseptic dressing, and strapping the entire side with broad adhesive strips to favor absorption of the hæmatoma.

From this time on until the afternoon of the first day of the fourth month (which was six days after admission), temperature and pulse ran practically a normal course. On the afternoon of the sixth day, temperature rose to 102° F., pulse to 102, subsiding, however, at midnight of the same day. From this period until the sixth of the month (or the eleventh day after receiving the wound) there were no untoward symptoms. At this time temperature again ran to 102° F., pulse to 102. On the seventh day, temperature had again dropped to normal, pulse to 100, respirations 24. On the morning of the eighth, temperature again rose to 102° F., pulse 92, respirations 20. (This was the fourteenth day.)

At no time after the day of admission were respirations above 24. Urine was voided normally and bowels acted regularly. Only once does the temperature chart show the necessity for administering an enema.

About 7 P.M., on the fourteenth day, when apparently in the very best condition, indeed unwillingly retaining his bed, the patient was attacked with vomiting and died almost instantly.

Autopsy.—The autopsy was made about fourteen hours after death, having been held by the Coroner's physician assisted by the resident, Mr. Davies.

The bullet, a thirty-two caliber, had entered the thorax at a point one and a half to two inches above the ensiform cartilage, and one and a half inches to the left of the sternum, fracturing the rib at that point, passing through the pericardium and through the apex of the heart, making a wound in depth about one-quarter of an inch. It then passed through the pleura and gained exit from the thorax between the sixth and seventh intercostal space, being found in the subcutaneous tissues, after having passed through all the deeper tissues of the back. Its presence could not be early detected on palpation because of the presence of the immense hæmatoma, and later because of its being embedded in organized blood-clot. The entire heart muscle was enveloped within a well organized blood-clot, and about a gallon of serum and blood was removed from the pericardium and pleural cavities. All the other organs were apparently normal.

There were not, from the time of the patient's recovery from shock until his death, any of the cardinal symptoms of wound of the heart present, such as prostration of strength with swooning or syncope, thready or weak and irregular pulse, precordial distress and anxiety, nor dyspnœa, and, in the absence of these, earlier liberty was given both as to moving about in bed, also to diet, than would have been allowed had these symptoms been present to have warned of the nature of the injury. There is much reason for the belief that had the cause of this intercurrent attack of vomiting been averted, the patient would have entirely recovered the injury to his heart. The literature shows a number of cases of bullet wounds of the heart where complete recovery has taken place, and also instances where, owing to entire absence of symptoms that would cause suspicion of involvement of the heart, deaths have occurred that might have been averted.

George Fischer,[1] in his collective report of 452 cases of heart wound, records 380 deaths and seventy-two recoveries. Death was immediate in 104. In 270 it occurred after intervals varying from one hour to nine months. Of this number seventy-two were gunshot wounds, with twelve recoveries; autopsies on several of the cases that had recovered, they having died from other diseases, verified diagnosis made long after the original injury. This circumstance affords good ground for supposing that the others were correctly diagnosed.

P. S. Connor[2] reports a case of gunshot wound of the heart wherein both ventricles and the right auricle were involved, yet the patient lived three years, two months, and thirteen days.

Steudener[3] reports a case of pistol-shot wound of the heart with survival for fifteen weeks. In this case autopsy showed a cicatrix to be present at the apex of the left ventricle corresponding to the wound in the pericardium, grains of powder also being found embedded in the substance of the heart.

Sir James Fayrer[4] mentions a case of bullet wound of

the heart where the patient survived seventy-two days. The bullet was found in the apex of the left ventricle.

Tillaux [5] exhibited at the Société de Chirurgie the heart of a woman who had survived two gunshot wounds for eighteen days, one of the missiles lodging in the left ventricle.

H. W. Boone [6] reports a case of gunshot wound with survival for thirteen days.

Richard J. Booth [7] reports the case of a woman who died twenty minutes after admission to the Kimberly Hospital, South Africa, suffering from penetrating wound of the pericardium and left ventricle.

James Berry [8] reports the case of bullet wound of the heart in which the bullet passed through the cavity of the right ventricle and intraventricular septum, emerging close to the inferior vena cava, patient surviving one hour.

O. B. Beer [9] reports the case of an old soldier who was wounded in 1861 by a small rifle-ball entering the thorax posteriorly, on the left side, between the second and third ribs, it being found embedded in the heart wall near the left ventricle, thirty-seven years later, the patient having succumbed to cancer of the arm.

G. P. Biggs [10] reports a gunshot wound of the heart where patient survived three days, bullet entering the thorax inside the left nipple line.

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MEASUREMENTS FOR OPERATING DISTANCES IN THE NOSE.

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I HAVE measured sixty-four half heads representing at least fifty whole heads in order to get an idea of the operating distances in the nose. The measurements were made on wet specimens. The central figures in large type are the measurements which occurred the greater number of times, not the mathematical average. The figures in small type, before and after the central figures, are the maximum and the least meas-

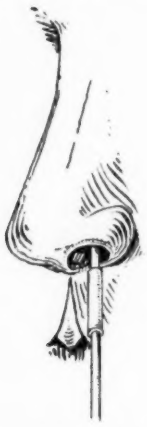

FIG. 1.—Drawing to show the point from which measurements were taken.

urements. Certain of these measurements have been duplicated by others. As their measurements were made from the middle of the nasal opening, they are greater than mine. My measurements were made from the lower edge of the posterior rim of the nasal opening (Fig. 1). All vertical measure-

ments were made close to the junction of the septum and the cribriform plate. If measurements are not made in this way, the probe enters the lateral mass of the ethmoid, where it mounds up above the cribriform plate and the measurements are increased one-eighth to one-quarter of an inch. Since most of us visualize inches and fractions of inches more readily, the measurements are given in these.

In the measurement from the upper end of the infundibulum horizontally forward to the root of the nose, the upper

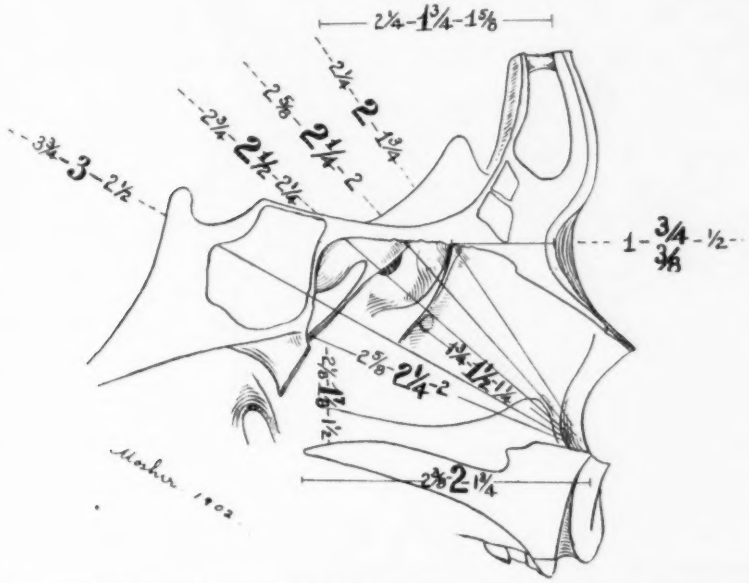

FIG. 2.—Operating distances obtained from the measurement of sixty-four half heads. The lachrymal duct is not given on this diagram. The average distance is one inch.

of the two central figures is the average distance, but, owing to the slope of the posterior wall of the frontal sinus forward, the working distance is much smaller. The lower of the two central figures is the average working distance. The smallest working distance which I found in this place was one-fourth of an inch; the greatest, one-half of an inch.

In order to find the relation between the measurements

made on the cleaned skull and those made on the wet specimen, I measured fifty-six skulls. In these the average measurement to the cribriform plate at the upper end of the infundibulum was one and seven-eighths inches. The maximum and the minimum measurements were two and one-eighth and one and one-half inches. The average measurement to the anterior wall of the sphenoidal sinus was two and one-eighth inches.

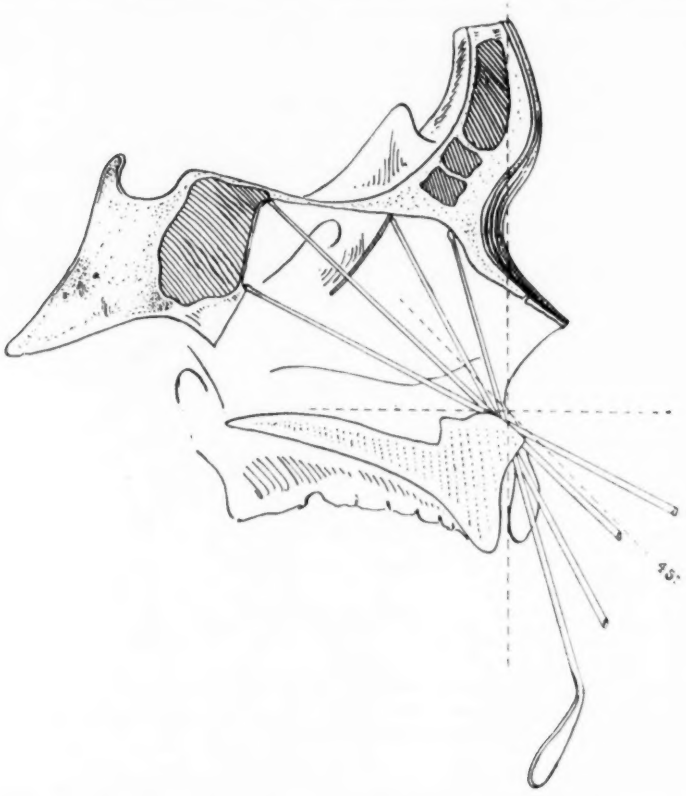

FIG. 3.—Drawing showing the angles at which a probe must be introduced in order to touch the various points of the nose.

The maximum and minimum, two and nine-sixteenths and one and seven-eighths inches. This shows that in wet specimens and in the living, one-eighth to one-quarter of an inch has to be added to the measurements made on the cleaned skull.

These measurements on the cleaned skull were made from the lower edge of the nasal notch, taking the deeper of the two openings when they were not alike. This is fairly common. However, in the rather coarse measurements which are possible in life, this occasional difference between the two sides can be disregarded.

My material offered but little opportunity to try for a ratio between the different measurements and any of the diameters of the skull. I experimented a little with the anterior posterior diameter, but nothing came of it. Grunwald tried for something of the same sort, but established nothing. Personally, I feel that heads vary so much that it is rather improb-

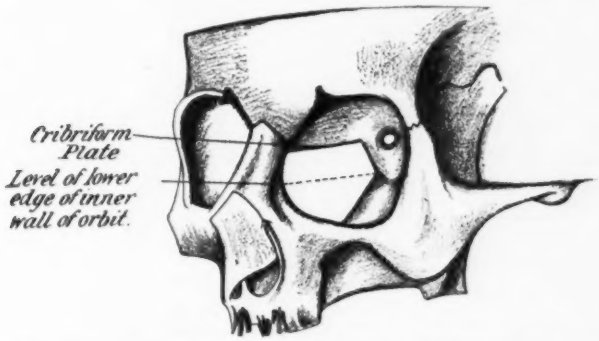

FIG. 4.—Drawing showing the level of the cribriform plate. The inner wall of the orbit and a part of the floor have been taken away.

able that any ratio of practical importance will be found. At present, all that can be done is to expect large measurements in large heads, and the reverse in small heads. I found, however, that the smallest measurements occurred in heads with toothless jaws.

The results of these measurements are given in Fig. 2. The position of the lachrymal duct is not given in this figure. The lower opening of the duct is placed under the anterior end of the inferior turbinate about two-thirds of the way to the opening of the antrum. This would make the average distance one inch.

In making the measurements of the floor of the frontal

sinus, I was struck with the fact that if a burr is entered at the upper end of the infundibulum and passed directly upward in order to open the frontal sinus, it will in the majority of cases enter the cranial cavity. This is due to the frequent sharp slope forward of the posterior wall of the sinus. In order to enter the sinus from this point, the burr should point forward at an angle of 45 degrees, and would have a working distance of half an inch. In order to bore straight up into the sinus, the probe must be held parallel with the teeth and close to them.

The direction in which the probe must be pointed in order

FIG. 5.—Drawing to show the horizontal planes of the cribriform plate, the ostium maxillare, the lachrymal duct, and the Eustachian tube.

to touch the various parts of the nose is shown in Fig. 3. From this diagram, which is taken from a tracing of a probe in these different positions, it will be seen that in order to touch the sphenoid bone the probe must be at an angle of 45 degrees, or between this and an angle of 67.5 degrees.

There is one other point in the applied anatomy of the nose which I looked up, and that is the level on the face of certain of the internal landmarks of the nose. I found in a majority of my specimens that a line passed one-quarter of an

inch above the lower rim of the orbit and carried horizontally backward passed through ostium maxillare; a line one-quarter of an inch below the rim cut the lower opening of the lachrymal duct; a line one-half of an inch below the rim passed through the upper border of the opening of the Eustachian tube. Fifty cleaned skulls gave the level of the cribriform plate as the mid-point of the inner wall of the orbit, and wet specimens showed that this point is one-eighth of an inch above the inner canthus of the eye.

These levels, of course, are not absolute. The opening of the antrum may be on a level with the lower rim of the orbit, not one-quarter of an inch above it. In the same way the opening of the lachrymal and the Eustachian tube may move up; but the level of the cribriform plate—and this is the important one—I found to be rather constant.

I recognize fully, I think, the variability of these measurements, and that their total number is small. In spite of this, they furnish a certain amount of help, and so they are put out.

CONTRIBUTION TO THE SURGERY OF CLEFT PALATE.

A URANOSTAPHYLORRHAPHY SUITABLE FOR CERTAIN CONDITIONS.[1]

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OF CHICAGO,

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THE operation about to be described is not intended to take the place of all others, nor to supersede the one produced by the author two years ago, viz., "A New Uranostaphylorrhaphy" (*The Journal of the American Medical Association*, May 16, 1900).

It will be found suitable for cases where the roof of the mouth is like a Gothic arch,—the palate segments extending upward into the cleft in a more or less oblique manner, and where the cleft extends into one nostril. Two mucoperiosteal flaps are liberated,—the one from the inner segment turned downward into the mouth, and that from the outer segment passed into the nostril; when these coapt raw surface to raw surface they overlap, and are held there by a few stitches. It has been done by the author only four times. The results have been very good.

The preparation of the patient is both general and local.

The constitutional condition is important. It is well not to operate on a patient suffering from malnutrition, anæmia, bronchitis, etc., until these conditions are rectified. The local

[1] Read before the Chicago Surgical Society, April 7, 1902.

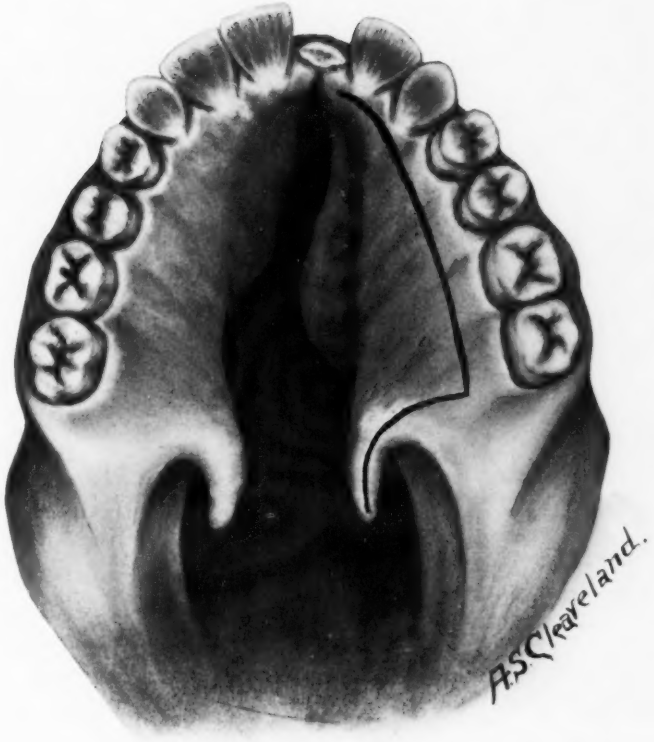

FIG. 1.—Showing incision for the correction of cleft palate.

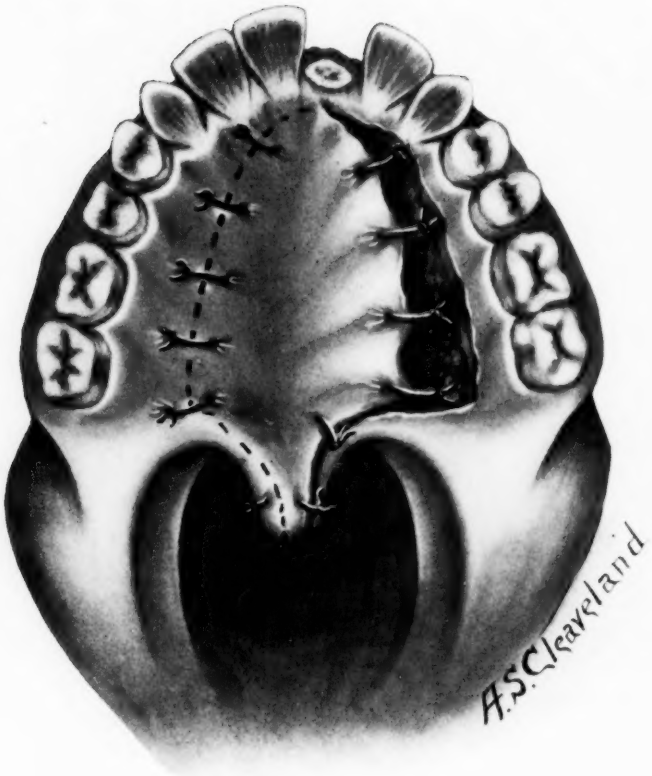

FIG. 2.—Coaptated raw surface to raw surface by means of two rows of stitches.

preparation is directed to counteract nasal catarrh, the removal of adenoids, and diseased tonsils.

Just before the patient is put asleep, a dose of atropine, suitable to the age, is given hypodermically to check the salivary and mucous secretions while operating.

Operation.—Administer chloroform by the spray method; place the patient in the Rose position; sit at the head of the patient; open the mouth with a gag; cleanse the face and mouth with a lotion of equal parts of alcohol and water, and cocainize the soft palate, pharynx, and larynx.

Raise a mucoperiosteal flap from the nasal septum and inner segment of the hard palate and drag it into the mouth with Brophy's hoe-shaped periosteal elevator. The instrument just mentioned is quite sharp and easily cuts through the mucous membrane and periosteum.

The formation of this flap is commenced as high in the nose as possible, and it (Fig. 1, *a*) is liberated from above downward till it is hinged by its attachment to the hard palate along the teeth. Now extend the incision in the under surface of this segment of the soft palate and uvula so as to make the completed dissection form one large flap from the hard and soft palate. The second flap is now formed from the outer segment by making an incision along the teeth (Fig. 1, *b*) down to the bone, and with a periosteal elevator detach a mucoperiosteal flap till it is hinged by the mucous membrane along the inner border of the bone segment. The soft palate and uvula segment on this side is now split along the anterior surface. The mucous membrane on the first flap faces downward while that of the second flap is on the nasal aspect, and when coaptated raw surface to raw surface they are held there by two rows of stitches (as represented in Fig. 2).

CASE PRESENTED.—I operated on the palate of this sixteen-year-old girl three weeks ago to-day after the method described. The harelip was repaired when a child. The segments of the hard palate extended upward into the left nostril. The cleft was half an inch wide in the centre, became narrower towards the incisor

teeth, and broadened as it extended towards the soft palate. The result is excellent, even to the formation of a uvula.

The roof of the mouth now is like a Norman arch, very firm and strong. The speech has already improved, and, in order to do away with the nasal twang, I have advisecl her to learn either French or German and forget her English altogether. It is claimed that these persons speak the languages acquired perfectly, and when they relearn the English language that the nasal intonation is not present.

Dr. A. J. Ochsner was the first I heard to recommend this some four years ago. Since then I have advised it in several cases with most promising results.

TOTAL EXCISION OF THE SCAPULA, WITH PRESERVATION OF THE UPPER EXTREMITY.

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Excision of the entire scapula alone is a comparatively rare operation, and this case is, so far as I have been able to ascertain, the first one performed at the Charity Hospital of New Orleans since Logan's successful case in 1871. The degree of usefulness of the extremity is so great, after such an extensive removal of the bone, that I deem the case worthy of record.

Total excision of the scapula, with preservation of the arm, is an operation which has been performed only in the past half century. In conditions other than malignant disease, the permanent results of the operation have been most gratifying. With the exception of slight impairment of abduction, all the motions of the arm are retained, and its usefulness but little impaired by the operation.

To Langenbeck we are indebted for the first operation of this kind. This was done in 1855, on a boy of twelve years, who lived for three and a half months after the operation, and finally died of a recurrence of the malignant disease. Like all scientific innovations, Langenbeck's achievement was but the outcome of a gradual evolution. First proposed by Liston in 1819, it was reserved for the following surgeons to really contribute to the subject in a durable form. In 1824, Jansen, of Lyons, removed the entire body of the scapula; in 1830, Skey, of London, removed all but the glenoid process; in 1849, Sentin removed all but part of the acromion; in 1850, Lan-

genbeck removed all but the coracoid process; and in 1853 Bruns all but the acromion and coracoid processes. The operation was further elaborated by Ferguson and Syme in England and Scotland, by Petreguin and Berger in France, by Reed in Germany, and Gross and Stephen Rogers in America.

CASE.—A negro bootblack, born and reared in New Orleans and twenty years of age, was admitted in the Charity Hospital on July 16, 1900, with the following history: At the age of five he contracted smallpox, which is evidenced by his well-pitted face, and about four years ago he accidentally shot himself in the left eye, losing that organ. Otherwise he has enjoyed good health until a year ago, when he noticed a slight stiffness in the movements of the right arm, accompanied by a moderate swelling at the corresponding shoulder. It caused him no pain, only a slight discomfort on certain motions of the shoulder-joint, or when he lay upon the affected side. These symptoms remained about the same until two weeks before admission, when he experienced pain and more difficulty in using the arm, and was not able to work at his trade with his usual facility.

Examination on admission showed a suppurating sinus on the back at the junction of the spine and spinal border of the scapula. The pus that exuded was thick and very foul. Thoracic examination proved negative. He had lost flesh and strength since the appearance of the ulcer and looked somewhat anæmic. The skin was normal in appearance and freely movable over the scapula.

On July 24, under chloroform anæsthesia, a free incision was made along the spinal border of the scapula for the purpose of ascertaining the extent of the disease. On examining the parts thus laid bare, it became at once evident that conjoined caries and necrosis were so extensive as to require the excision of the whole bone. Exploration with the index-finger showed that the long-continued suppuration had caused some separation of the periosteum; indeed, quite a part of the outer surface of the bone was stripped of its periosteal covering.

The vertical incision was now promptly extended to about an inch beyond the inferior angle of the scapula, so as to give ample room to get beneath and around that part of the bone and

lift it up. This was readily effected after the soft parts had been divided and the flaps over the dorsum dissected up. With the inferior angle held up, the subscapularis muscle was stripped from the under surface of the scapula and temporarily left in the wound. The axillary border of the scapula was now freed from its muscular attachments, and a second incision at right angles to the vertical one was made over the spine, ending at the acromion process. The deltoid and trapezius were detached from the spinal attachment, and the upper margin of the bone was thus cleared of the muscles. This freed the diseased scapula from the chest, so that it could be lifted up from the ribs and tilted outward and forward, exposing the shoulder-joint. This was now opened from above and behind, at the same time keeping close to the glenoidal attachment, so as to retain as much of the capsule as possible for the new joint.

At this stage of the operation the coracoid process was dissected away from its muscular attachments by a division of the tendons of the pectoralis minor, biceps and coracobrachialis, and also of the coracoclavicular ligaments. By keeping the knife close to the bone, no difficulty was experienced in freeing it. The amount of hæmorrhage was unexpectedly small, no artery of size being tied; but three or four ligatures were used.

This vast area thus exposed was thoroughly irrigated with an antiseptic solution and dried. The capsular ligament was then sutured to the soft parts right under the acromial process of the clavicle, and the muscles sutured in such a manner as to secure them in about their normal relation. The wound was united with silkworm-gut sutures, and a small gauze drain was left in the angles. The arm was carried to the side and crowded well up to the acromial end of the clavicle. The forearm was flexed and supported in a sling. The operation was attended by remarkably little shock and by little loss of blood.

In the later course of the case there was hardly any reactionary fever. The patient slept, ate, and drank tolerably well, and the wound united in a great degree by primary union, so far as the skin was concerned, though a somewhat prolonged suppurative process took place beneath, the discharges finding vent through two openings,—the one provided at the operation and a counterpuncture made afterwards higher up, where the pus seemed to bag somewhat, and thus required a freer outlet.

The wound had completely cicatrized by about the middle of December; the health of the patient was fairly good to all appearances. At the time of his discharge, five months after the operation, he was much improved in health, and the general and local appearance were as the accompanying photographs represent. An examination of the patient at the time showed that he possessed all the voluntary movements of the arm. He could, besides these movements, elevate the arm from the side between twenty and thirty degrees. Subsequently, all the voluntary movements acquired still greater range. So useful had the extremity become, that shortly after his discharge he resumed his work as a bootblack. When dressed, the resulting deformity was scarcely noticeable.

Consequences of the Operation from a Functional Standpoint.—An examination of the patient at the time of his discharge as to his motor and sensory functions was made. All these functions are perfectly performed with the exception of abduction, which is diminished by fully one-half. This is easily explained, as the deltoid muscle, the only abductor muscle of the arm, had lost half of its origin, and the head of the humerus no longer had a firm *point-d'appui*.

External rotation of the upper extremity is performed with ease, showing that the supra- and infraspinatus and teres minor muscles are not altered. The adductor muscles, the latissimus dorsi, teres major, and pectoralis major not being in any way disturbed, adduction is readily performed. One would suppose that flexion and extension of the forearm would be impaired, owing to the loss of insertion of the two heads of the biceps and of the long head of the triceps; but this was not the case. The respiratory muscles must also be considered,—the serratus magnus, the pectoralis major and minor. The pectoralis major is left intact; it has no connection with the scapula, but is an auxiliary suspensor of the upper extremity. When its insertion in the humerus is the fixed point, it acts as an inspiratory muscle. After disarticulation of the scapula, this action is impaired. The pectoralis minor is also an inspiratory muscle when its fixed point is at the scapula; deprived of that point its inspiratory action is lost. The serratus magnus is likewise an inspiratory muscle, especially its upper portion, when its fixed point is in the scapula. For this function, it must receive the aid of the rhomboideus

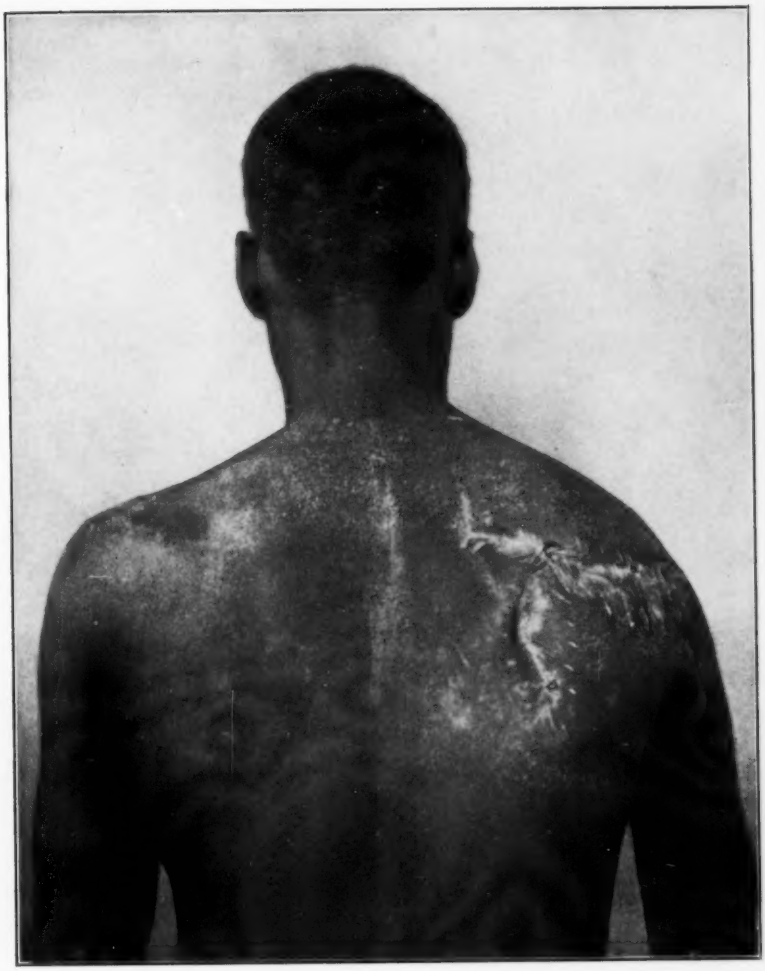

FIG. 1.—Result after total excision of the scapula, posterior view.

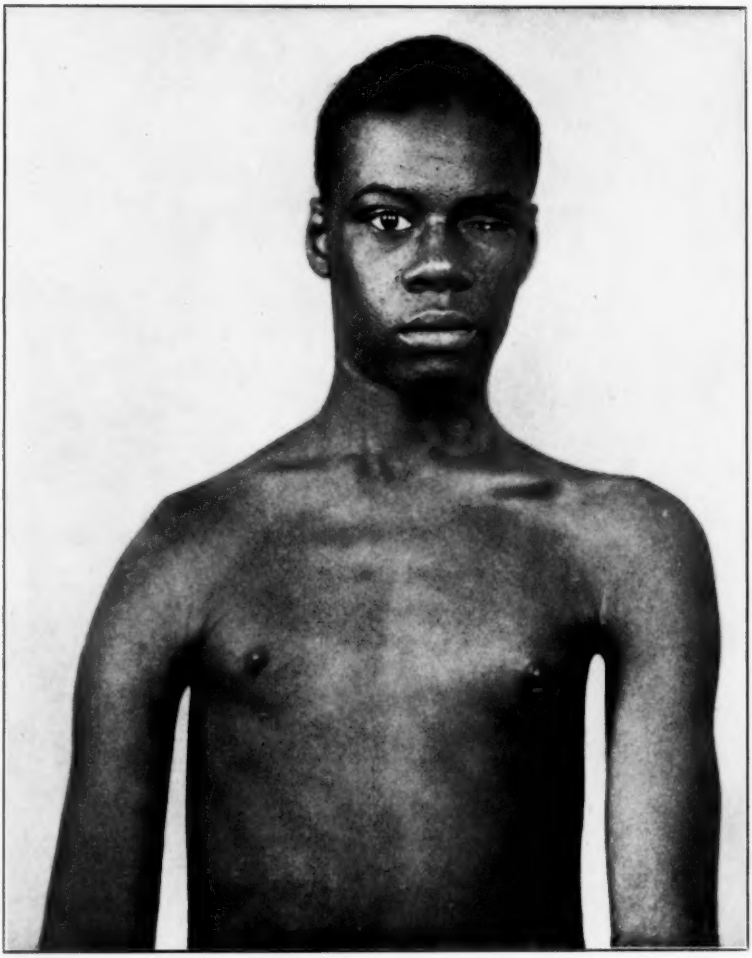

FIG. 2.—Result after total excision of the scapula, anterior view.

major and minor. These muscles being incised, their action as respiratory muscles is impaired. Hence, after a total excision of the scapula, the pectoralis major and minor and the serratus magnus muscles are no longer extraordinary inspiratory muscles.

I cannot help thinking that this impairment of the respiratory movements of one-half of the chest can but have an unfavorable influence over the lungs, cause it to become atrophied by reason of its diminished physiological activity, and expose it to tuberculosis infection.

All the muscles mentioned above responded to electrical stimulation. No delay in the perception of sensations was experienced. Common sensation (touch) and sensation to pain were just as acute as on the unaffected side. There has been no modification in thermic sensibility. There seems to be little retraction of the muscles in aponeurotic spaces of the arm, as the triceps and biceps. There has been no muscular atrophy, no changes in the sudoral secretion, no hypertrophy of the nails, in fact, no trophic change of any kind.

The strength of the upper extremity was tested. He can lift readily any moderately heavy article. He can place his hand on either ear or shoulder, on the back of the neck, and can pass his hand over the whole of his forehead and face and behind his back. He can bring his hand to sweep over the whole face and cheek. The degree of usefulness remaining to the limb exceeds anything that I could expect. There is a considerable amount of hard, fibrous material about the new joint, and, as a result of this rigid condition of the parts, the upper extremity of the humerus, itself involved in the mass, is held much more firmly in position than would otherwise be the case, assuring the stability of the humerus.

An attempt at a radiograph was made, but was not sufficiently satisfactory to be reproduced here. It was instructive in so much as it showed the relations of the head of the humerus with the clavicle.

Indications for Operation.—Conditions requiring excision of the scapula are three in number. The first is traumatism, such as gunshot wounds, and here military surgery supplies a great number of cases; the second is from acute or chronic inflammatory lesions (osteomyelitis, necrosis, tubercu-

lous ostitis); and, thirdly, from tumors, benign or malignant, which require total or partial resection of the bone. In some cases of excision of the scapula, the operation is limited to the removal of the scapula only; in other cases the operation is complicated by the excision of neighboring bones or of the entire upper extremity.

Excision of the scapula and the upper extremity has been advised in the treatment of tumors of the scapula or of the superior extremity of the humerus. In several instances resection of the upper extremity of the humerus, together with the scapula, has been practised, whether the head of the bone was diseased or not.

In some cases the excision of the scapula was a secondary operation, necessitated by a recurrence of the cicatrix from a former operation of the disarticulation of the upper extremity for a neoplasm.

Lastly, partial or complete resection of the scapula was done in cases where the lesion was localized or had invaded the whole bone, or when the nature of the affection aroused or not the idea of a possible recurrence.

In the report of this case, it is my purpose to limit myself to the consideration of tuberculous affections of the scapula. This affection is rare, and when observed in its incipiency is localized in a part of the bone. More frequently, however, hospital patients, before seeking relief, wait until the affection has invaded the greater part or the whole of the bone.

Berger, in his work on interscapulo-thoracic amputation, states that in any tumor of the scapula of a malignant nature (sarcomata, carcinomata, etc.) the operation is justifiable. According to the same author, the question narrows itself to the choice between total excision of the scapula and interscapulo-thoracic amputation. The latter operation, though the more serious one, is less frequently followed by recurrence. Still, he considers resection the operation by election, and recommends interscapulo-thoracic operation only in cases when the first operation cannot be done.

As to partial resections, statistics seem to show that they

were performed by two different ways. In one the operation was limited solely to the removal of the diseased portion of the scapula; in the other operation, not only the diseased portion was removed, but the whole scapula was excised, with the exception of the acromial and coracoid processes and the glenoid fossa, in fact, the axillary angle of the scapula. The latter operation was usually adopted in the hope of limiting the disease and preventing any recurrence; also in the hope of preserving for the patient muscular functions.

Stephen Rogers thinks that the danger from total resection is less than from partial resection and resections leaving the anterior angle.

The literature upon the subject at the present time, disseminated over a vast field of periodical publications, has been gathered by Buchanan, in the *Philadelphia Medical Journal*, 1900, Vol. vi, into a form to make it useful for the guidance of the surgeon. In a most elaborate and painstaking article the author has in a concise form brought the subject up to the latest theories, and compiled a most complete set of statistical tables, which embody the history of operations involving the loss of a portion or the entire scapula, in their chronological order. This article is the more instructive as our standard works on surgery are silent on the subject.

We do not learn from the exhibit of these tables that the removal of the entire scapula is a more serious operation than the removal of the greater part of it, for it appears that of the ninety-four cases in which more or less of the scapula was removed, eleven died of causes more or less directly connected with the operation. Now, if we look at the cases in which the entire scapula was removed preserving the arm, and in a few of them the clavicle was involved also, we see that death as a result, even remotely, of the operation, occurred in but few of them. This result is in support of Stephen Rogers's opinion that the removal of a large part of the scapula for disease is a more dangerous operation than the removal of the whole bone.

While, unfortunately, no new light upon the pathology or the progress of operations performed for cancerous disease

is afforded by these tables, it stimulates the brightest hopes for the operation of removing the scapula preserving the arm, where the destroying disease is caries or necrosis. In fourteen operations death followed in one only, or 7.1 per cent. Now, as regards the immediate danger of the operation, this does not appear to me to be great.

In estimating the probable constitutional depression which the removal of the scapula is likely to produce, surgeons appear to have been uninfluenced by the histories of many recorded cases of the accidents by which the arm, including the scapula, has been torn from the body by machinery. Rogers reports eleven such cases, all recovered.

It will be observed that cases of excision of the scapula have been uniformly attended by little loss of blood and by remarkably little shock. No ligatures were employed in most of them, because there was no hæmorrhage requiring them, and recovery has been uniform.

It will probably be noted that no allusion has been made to the subject of the comparative usefulness of the arm in case of the removal of all or the greater part of the scapula. So far, then, as experience goes, we have no reason to think that the utility of the arm is much, if any, increased by leaving a piece of the scapula, including the glenoid cavity.

Results.—In an analysis of about 200 cases, Buchanan concludes that if, by removal of less than the entire body of the scapula, the growth can be entirely extirpated, the operative mortality is least, while the probability of a permanent cure is greater than if the entire bone were removed. If, however, the removal of the diseased tissue requires excision of the entire body of the scapula or more, then the immediate mortality becomes greater, and the probability of permanent cure less than when the total extirpation of the bone is practised. In cases of tuberculosis, osteomyelitis, and necrosis, where the entire body of the bone requires removal, total excisions are no more dangerous than partial ones.

As a whole, the mortality from total extirpation for all cases, as taken from Buchanan's tables, was eleven from sev-

enty-two cases, or 15 per cent.; the cause of the death being especially from sepsis and hæmorrhage. In the group of partial extirpations we note seventeen deaths from ninety-four cases, or 18 per cent. In the second group of the partial extirpations, we find one death from twelve cases.

It must be remembered that the majority of these operations were performed in the pre-aseptic epoch, and with appliances which have been perfected in our days. For that reason the above figures have fortunately lost much of their importance.

It is certain that the results above mentioned are not sufficient to arrive at a definite appreciation. In cases of malignant disease, it would have been interesting to compare the percentage of recurrence in total excision, with or without the resection of the head of the humerus, and partial excision. We would thus have been able to decide which of the operations assured greater protection from recurrence. From a study of these statistics, we conclude that none of the operations practised offer absolute protection from recurrence; even total excision, the most radical of all, still furnishes too great a percentage of recurrence. Be this as it may, total excision, not being followed by a greater mortality than from any other of the operations, recommends itself in cases of malignant tumors, and, in my opinion, Langenbeck's advice to retain the coracoid process and glenoid fossa for better muscular movements should not be followed. One consideration only could cause the surgeon to hesitate in the selection of the operation of total excision, and that is the functional impairment following that operation. And from a study of the case here reported, we have shown that in cases of necrosis and caries, functional impairment need not be feared; and, on the other hand, in cases of malignant growths, where functional results are of secondary importance, total excision assures greater security from recurrence.

The legitimate surgical character of the operation is no longer a subject of doubt; and we are not now liable to the criticism which was so severely bestowed upon Syme in 1856,

for having practised an operation which, at best, must leave a worse than useless arm, as was alleged. On the contrary, it is nowadays practised, defended, and urged with enthusiasm by the highest surgical authority.

There is no anatomical or pathological reason why the scapula should not be removed for any disease of the bone for which sound surgery would make it expedient to remove any other bone in the frame; and in malignant disease of the bone it is safer and better surgery, as it is in similar disease in all bones, to remove the whole rather than a part. The prognosis as to the value of the arm in case of removal of all, or part, of the scapula may be almost positively, and to a high degree, favorable.

A FURTHER NOTE ON INTERSCAPULO-THORACIC AMPUTATIONS.[1]

By ROBERT G. LE CONTE, M.D.,

OF PHILADELPHIA, PA.

THIS month, three years ago, I had the honor of showing a case of interscapulo- thoracic amputation before the Philadelphia Academy of Surgery, and of detailing a new method of technique for its accomplishment (ANNALS OF SURGERY, August, 1899). At that time I had absolute confidence in the safety of the method, and the belief that no serious accidents could occur during the performance of the operation. To-day, my confidence in the method is still unshaken, provided it is carried out with good judgment, but errors of judgment may bring about complications of the most serious character. It is for the purpose of detailing my own errors in this line that I again bring up the subject.

The safety of this operation for malignant disease lies in the control of hæmorrhage, particularly of the venous bleeding, for in some cases the venous channels exposed are as large as the ascending cava. For the purpose of exposing these veins as thoroughly as possible, I have advised the disarticulation of the sternal end of the clavicle instead of a resection of that bone. When the veins are of normal size, the operation may perhaps be performed safely by either method; but when the veins are enormously increased in size, the greatest exposure of the part gives none too much room for their ligation. It was at this point of the operation in the following case that I erred in judgment, and my errors nearly cost the patient his life.

[1] Read before the Philadelphia Academy of Surgery, May 5, 1902.

T. D., aged eighteen years, white, school-boy, born in Philadelphia, was admitted to the Pennsylvania Hospital, April 2, 1902. Family history negative. He has always been quite healthy, though never very robust.

Present Condition.—One year ago, while at school, he was frequently pummelled on the right arm by some of the boys, causing a feeling of soreness for several days. During the summer, while playing baseball, he noticed that he could not throw as far as formerly, and as time went on his ability to throw a ball diminished. In October he noticed a stiffness of the arm, with a tendency to flexion at the elbow, with slight pain on motion. Not until January was he aware that the arm was increasing in size. This enlargement was at first gradual and painless, and the flexion at the elbow increased slowly until two weeks before admission, when very rapid growth set in, accompanied by severe pain, especially at night, and a feeling of discomfort and distress from the weight and bulk of the arm, which rendered the limb useless and overbalanced him when moving about.

On admission the patient was pale, very slightly built, weighing 118 pounds; eyes prominent; temperature and respiration normal, but cardiac action much accelerated, pulse ranging from 120 to 130; no murmurs present. Lungs, other organs, and urine negative to examination. Blood count: red blood-corpuscles, 5,136,000; white corpuscles, 12,400; hæmoglobin, 87 per cent. The prominent eyes with rapid heart action were strongly suggestive of exophthalmic goitre.

The right arm reveals a growth about the size and shape of a large ham. (Figs. 1 and 2.) The tumor seems limited to the confines of the humerus, as the forearm, shoulder, and axilla are not visibly affected. Axillary glands not enlarged. The growth is hard and tense, and the skin over it brawny and markedly striated. The elbow is flexed almost to a right angle and cannot be extended. Movements of the hand and fingers on the affected side are limited, with a very pronounced wrist-drop, and a weak radial pulse.

Measurements.—Circumference: Right elbow, twelve and one-half inches; left elbow, nine inches. Right biceps, twenty-two inches; left biceps, eight inches. Right axilla, fifteen inches; left axilla, twelve and one-half inches.

April 24. ether administered. An incision was made through

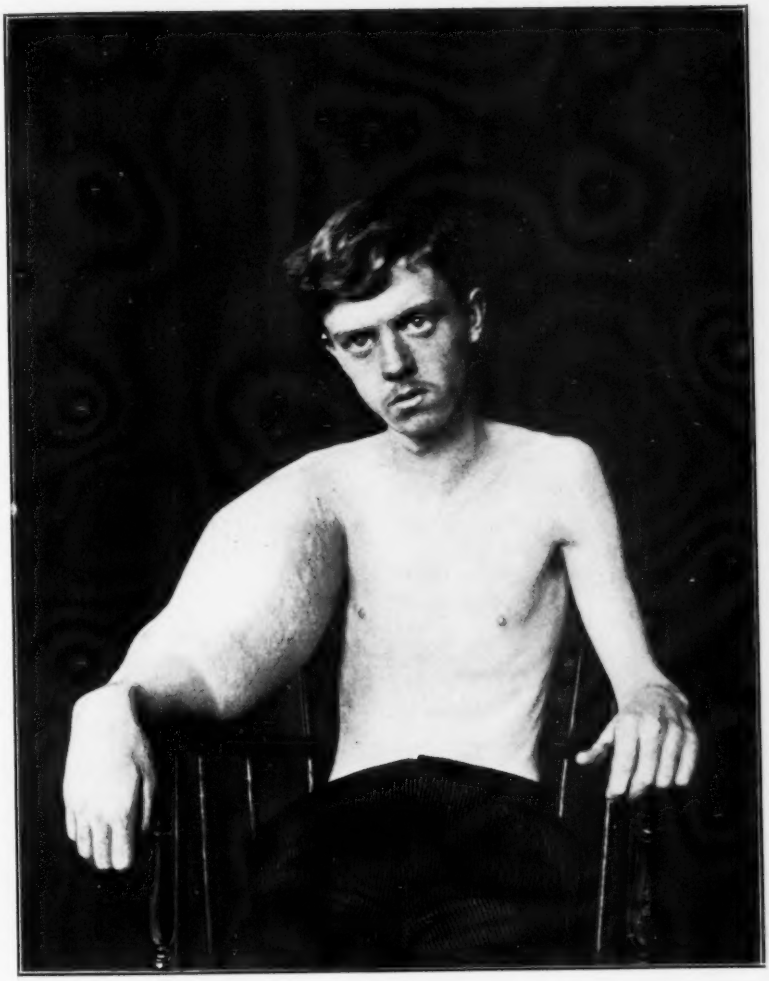

FIG. 1.—Sarcoma of right arm, anterior view.

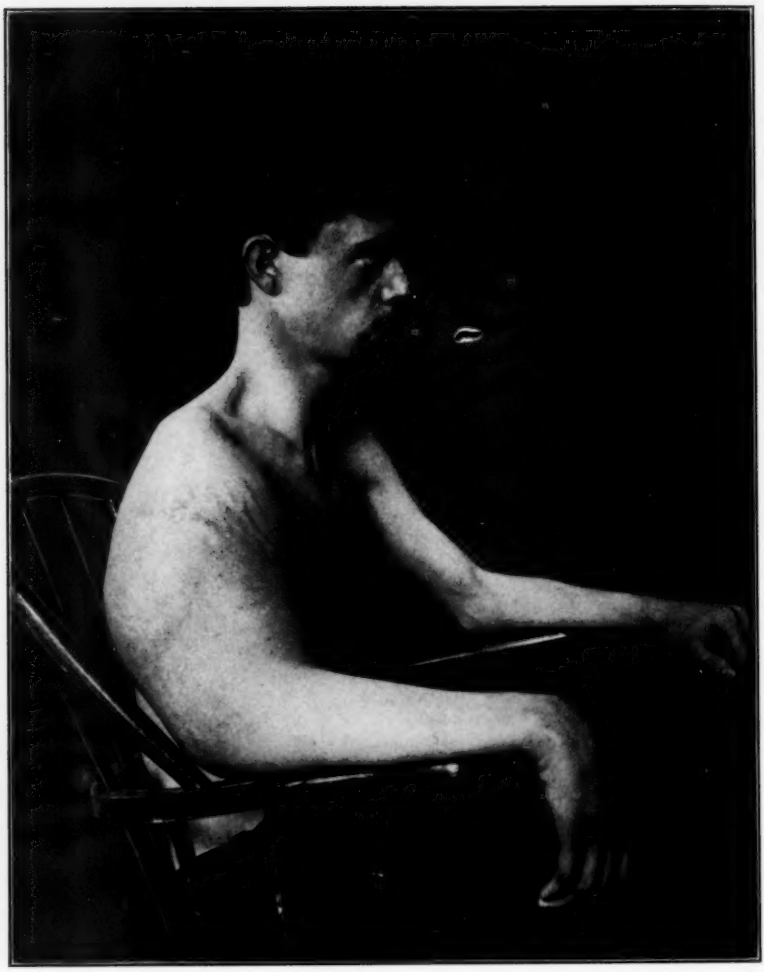

FIG. 2.—Same patient, side view.

the skin and superficial fascia from the sternum, along the clavicle to its middle, and then curved downward to the anterior axillary fold. The clavicle was disarticulated from the sternum with blunt, curved scissors, the rhomboid ligament and the clavicular portion of the sternomastoid muscle were divided, and the clavicular portion of the pectoralis major separated with the finger from the costal portion of that muscle up to the anterior axillary fold. The clavicle was now pulled upward and the subclavius muscle divided at the first rib. The pectoralis minor was then exposed, divided, and the coracoid portion reflected upward with the clavicle. Enormous venous channels immediately presented surrounding the anterior scalene muscle. A careful dissection revealed that the greatly enlarged cephalic vein joined the subclavian just in front of the anterior scalene muscle, and the vessel formed by this union was from an inch to an inch and a quarter in width. An attempt was made to expose the third portion of the subclavian artery or the first part of the axillary by retracting the veins, but it failed, and the vessel could not have been ligated in these positions unless the great venous channels had first been dealt with and severed. If the artery was to be secured first, and the blood in the arm saved to the patient, it seemed to me necessary to pass the ligature at about the junction of the first and second portion of the subclavian. This was done, and the vessel firmly secured with a chromicized catgut ligature, but unfortunately the pleura was also opened. In the presence of such enormous veins, which were now very turgid and flaccid with every inspiration and expiration, the noise of the air rushing in and out of the pleura was most alarming and terrifying, resembling my ideas of the sound of air entering a vein. A gauze sponge was packed deeply in the cavity over the pleural rent, the arm was elevated, and ligatures were passed around the veins,—one around the subclavian at a point which corresponded to the first portion of the artery, one at its distal portion before it had been joined by the cephalic, and one around the cephalic. These ligatures were tied when the arm had become fairly well blanched, and the vessels, together with a part of the brachial plexus of nerves, were divided. The ligature around the cephalic vein slipped and the wound was instantly flooded with blood. The hæmorrhage was quickly stopped with the finger and the vessel secured with two hæmostatic forceps and ligated. While dividing

the remainder of the brachial plexus of nerves, another large vein was opened, which produced a very alarming hæmorrhage. This was also controlled by direct pressure, and the vessel secured with hæmostatic forceps and ligated. It proved to be a large communicating branch from the cephalic to the jugular vein. These two hæmorrhages occurring with such a short interval between, and with the loss of several ounces of blood in a few seconds, rendered the condition of the patient most precarious. He was almost pulseless, and respiration was shallow and irregular. Hypodermics of strychnine and digitalin were given, while an assistant opened a vein in the left leg and introduced two quarts of hot normal salt solution. During these procedures the rent in the pleura was stitched up with catgut, the patient turned on his left side, and an incision dropped to the lower angle of the scapula and up to the anterior axillary fold. The scapula was rapidly freed from its attachments, and the two skin incisions joined through the axilla, completing the detachment of the upper extremity. Three or four vessels required a ligature. The wound was closed with silkworm gut, a rubber drainage tube coming out at the lower angle, and at the sternal angle a wick of gauze led down to the pleural rent. The time of operation was fifty-five minutes, and the patient's condition at the close was fairly good.

For a week following the operation the patient's temperature ranged from 99° to 101° F., the pulse-rate from 110 to 140, the cardiac action being accelerated under the slightest exertion. On the third day the gauze wick and the drainage tube were removed, and on the ninth the stitches were taken out, and the wound found in excellent condition, with good union. At both these dressings there was evidence of a right-sided pneumothorax of slight degree, the expansion of the chest being about equal on both sides, and the heart in its normal position. Dr. Frederick A. Packard very kindly saw the patient with me, and concurred in the belief that Graves's disease was also present. For these reasons the patient has been kept quiet in bed, and will now be placed on small doses of suprarenal gland. Dr. Longcope, the resident pathologist of the hospital, has kindly furnished me with the following notes of the tumor.

Report of Pathologist, No. 5335.—The specimen consists of the entire right arm amputated with scapula and clavicle attached. The upper arm

presents an enormous fusiform swelling reaching from the head of the humerus to the elbows. The arm weighs 7000 grammes. The skin over the swelling is discolored bluish, and there is a streaking somewhat similar to the lineæ atrophicæ of the abdomen. The elbow-joint is slightly swollen, but the forearm and hand appear normal. The swelling is hard and firm. On section, the tumor is found to be an enormous growth, arising evidently from the periosteum of the humerus. It is fusiform in shape, and reaches its greatest thickness about the middle of the humerus, where it surrounds the bone in a collar 8.5 centimetres in thickness, being separated from the skin only by the superficial fascia and subcutaneous fat. The growth is generally firm, pearly white, and slightly translucent, having an irregular outline, which in some places is fairly well circumscribed, but in others appears to infiltrate between the muscle bundles.

Large ragged cavities occur throughout, often measuring 4.5 or seven centimetres in diameter, and being filled with a clear yellow fluid. A portion of the free surface of the bone forms the wall of one of these cavities. The bone is covered with small, soft, tooth-like elevations which project like the quills of a porcupine. Some of them are calcified. Near the elbow much of the growth above the bone contains areas of calcification. At the upper end the growth has broken through the capsule into the elbow-joint and forms a lobulated, firm, gray mass near the head of the humerus.

Both the subcutaneous tissue and muscles are greatly œdematous, the muscles being exceedingly pale and streaked. They are all so compressed by the growth that the various groups of muscles cannot be distinguished. The branches of the brachial plexus are compressed by the growth, and the musculospiral nerve is lost entirely in the tumor mass. The vessels are clear. The axillary glands are enlarged, often the size of beans, œdematous, and soft. No macroscopic areas of growth are found in them. The growth does not involve the clavicle or scapula. The subscapular muscle is unaffected.

Section through the newer portion of the growth, which is invading muscle, shows it to be composed of large, irregular, and round cells grouped in a somewhat ill-defined alveolar arrangement. These alveoli are only distinguished by a fine stroma or single capillary which runs between them. A very fine net-work of stroma is likewise visible between the individual cells. The tumor cells are irregularly round or polygonal and vary somewhat in size. The nuclei are even more irregular than the cells; usually, they are oval or round and vesicular, the nucleoli being distinct, but frequently picknosis is present, or the nuclei are very large and pale. Both karyolisis and karyokinesis are common, and here and there a large multinucleated cell is seen.

In the older portions of the growth extensive degeneration has taken place: here the tumor cells are confined to areas about the blood-vessels, and both cytoplasm and nuclei show great irregularity in size and staining qualities. Some cells assume an elongated shape; others are very large and multinucleated, and the protoplasm contains large numbers of fat droplets or is vacuolated. The muscle surrounding the tumor is the seat

of an extensive interstitial myositis, large areas of muscle have undergone degeneration, and show slight infiltration of small round cells, epithelioid, and young connective-tissue cells. The muscle cells lying in mall areas between the degenerated portions are very small, irregular, and often broken. Their nuclei are greatly increased in number, and the striations are usually lacking.

The lymph glands from the axilla show an endothelioid proliferation with enlarged lymph channels. The keimcentra are swollen, but no tumor cells can be found.

Diagnosis.—Spindle-celled sarcoma.

To return to the technique of the operation. When the veins were exposed, and it was found impossible to ligate the third portion of the subclavian artery or the first part of the axillary, it was an error to ligate the subclavian at the junction of the first and second portions. Owing to its depth, its close relation to the pleura, its partial covering by the vein, and the close proximity of the phrenic nerve, such a ligation will always be attended by an immediate danger to these important structures. Secondly, the short distance from the innominate, together with the large branches given off in its first portion, subjects the patient to the remote danger of a secondary hæmorrhage, an event which would almost of necessity mean death. The ligation of this portion of the subclavian artery was therefore a distinct error in judgment, and led to serious complications.

Two other procedures were open to me, either of which would have been safe. First, the veins could have been ligated first, and after they had been severed the artery would have been readily exposed. This would have lost to the patient the amount of blood that remained in the arm, of some consequence, perhaps, but a much smaller risk than the one taken. Second, a still better procedure would have been to expose the axillary artery as high as possible, certainly its third portion and probably its second, and tie a temporary ligature about it. Then the arm could have been elevated, the veins ligated and severed, and a permanent ligature placed around the third part of the subclavian, and the artery severed in this portion. This could have been quickly and safely done, and would have saved to the patient the blood in the part amputated.

OPERATIVE DISLOCATION OF THE HEAD OF THE FEMUR IN TUBERCULAR DISEASE OF THE ACETABULUM.

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THE injurious effect from the head of the diseased femur crowded against an inflamed acetabulum can be seen in any pathological specimen of neglected hip disease.

Under exaggerated reflex muscular spasm incident to tubercular osteitis of the joint, the femur is flexed and adducted, and pressed upward against the upper rim of the acetabulum; the so-called wandering of the acetabulum results, and the head of the femur, distorted by disease and pressure, becomes displaced and dislocated. Cicatrizing osteitis follows in the acetabulum and head of the femur relieved from abnormal interarticular pressure; the destructive osteitis and the natural cure follow with deformity. The natural cure meets many of the indications of proper treatment of hip disease, which would be followed generally in the treatment of the disease, if it were not for the distressing deformity of the natural cure with its shortening dislocation and malposition. There is also a long period of pain and sensitiveness from the crowding of the inflamed surfaces together until a dislocation results, relieving exaggerated interarticular pressure and friction.

It is to prevent these evils that the modern treatment of hip disease is directed, diminishing interarticular pressure,

friction of the carious joint surfaces, and the deformity and shortening which follow neglected cases. The success of such treatment when thoroughly carried out is well known, and has been demonstrated in many special works upon the subject.

Certain cases, however, are occasionally met where conservative treatment presents difficulties and the pathological processes progress in spite of every effort. They are usually cases where the disease has made considerable advance and destruction before thorough treatment has been undertaken, or where there has been little resistance in the tissue to check the ravages of the tubercular osteitis.

Where the tubercular focus exists chiefly in the neck of the femur, and the head is but slightly diseased, it is evident that the tubercular slough is discharged readily, a cicatrizing osteitis established in its place, and a cure results readily under treatment which protects the head of the femur from destructive jar and pressure.

Such cases partially resemble those where the caries is situated chiefly in the trochanter and is benefited readily by extra-articular operations, curetting the foci. Where the diseased focus is primarily in the acetabulum, the difficulty of any treatment, either conservative or operative, is increased greatly. Not only is it more difficult to prevent destructive interarticular pressure from the muscular spasm of the muscles of the femur crowding the head of the femur upward towards the centre of the acetabulum, but the discharge of the necrotic tissues resulting from the carious process is less easily provided for in central acetabular disease than in any other part of the hip-joint. It is probable that many of the cases of hip disease which are unsuccessfully treated are those of primary disease of the acetabulum.

In the three instances in which this procedure was carried out, disease of the acetabulum was recognized by skiagrams. In one instance the head of the femur was slightly involved, though the acetabulum was extensively diseased. In all of the cases the condition of the child was desperate and suggested amputation of the hip-joint. The sinuses, the begin-

ning of cachexia, emaciation, pain and sensitiveness, and general deterioration in spite of ordinary treatment, indicated a progressing process which could be checked only by a radical surgical interference, the chief indication being thorough drainage from the acetabulum.

Where the acetabulum is involved and no dislocation has taken place, and the process is active, the difficulty of drainage is evident, as the head of the femur not only acts as an irritant aggravating the disease by crowded pressure upon the carious acetabulum, but the discharge of detritus, without which no healing can take place, is prevented by the head of the femur, which completely fills the socket. Drainage is finally permitted by the perforation of the acetabulum and the development of a pelvic abscess, which evacuates itself sometimes in the rectum, but usually by the development of an abscess lying beneath the pelvic peritoneum, which, burrowing under the tissues, finds an imperfect outlet by circuitous routes following the line of least fascial resistance. As these sinuses cannot evacuate themselves perfectly, cure is impossible, caries remains, and chronic septic changes become inevitable from retained discharge. Eventually, in many cases, dislocation of the head of the femur takes place by the partial absorption of the head and the widening of the acetabulum, thus relieving the pressure upon the bed of the acetabulum. Drainage becomes easier and recovery favored. In some instances, however, where the disease of the acetabulum is more active than that of the head, the increasing intra-articular pressure caused by the reflex contraction of the muscles around the head does not develop a dislocation, but drives the head of the femur directly towards the centre of the acetabulum, aggravating the perforations already caused by the caries.

Under these conditions, the patient is obliged to endure a long struggle against the evils following an imperfectly drained tubercular process.

The condition is not one of attempting to establish a cure without deformity, but of saving life at any cost, with or without deformity. If thorough drainage can be given and the

benefit of activity permitted, the conditions favoring a cure are offered to the patient. This can be accomplished if the head is dislocated and all pressure removed from the acetabulum, provided this dislocation is effected without such interference with the patient's general condition as will prevent moderate activity.

In the three cases operated upon, various incisions were used, the anterior, lateral, and posterior; the anterior incision being slightly to the inside of the tensor vaginæ muscle with incision of the capsule and dislocation of the head from the socket by means of forcible pressure. The fact that drainage is less readily afforded through an anterior wound than with a posterior wound is an objection to this method in severe cases. Where the side incision was made directly over the trochanter, the head of the femur could be reached, but it lay at considerable depth. The posterior incision, the usual incision for excision in the hip, seems to offer the best means of reaching the joint. The patient was placed upon the side, and a straight incision made down upon the neck of the femur. A cross-incision was necessary to open the capsule freely, a hook was inserted and placed around the neck, and with slight amount of force was dislocated from the acetabulum and placed upon the dorsum. The limb was in a flexed and adducted position, and the incision sufficiently long to allow the finger to enter freely into the acetabulum. The acetabulum was then curetted and touched with strong carbolic acid washed off with alcohol. A large celluloid drainage tube of the size of a round speculum an inch in diameter was inserted through the wound, reaching directly to the acetabulum. This drainage tube was easily made by boiling sheet celluloid and folding it around a tube of sufficient size. The celluloid becoming stiff on exposure to cold air, the edges were trimmed off, the lapping edges of the folded celluloid were secured by painting them with acetone, and the tube was cut sufficiently long to extend from the acetabulum to a short distance beyond the skin, which was stitched to the end of the celluloid tube. A direct communication could be made to the acetabulum, and

daily applications made upon the carious portions in the same way as applications are made upon an inflamed uterine cervix.

In one instance, the drainage tube was inserted below a flexed femur which was pulled upward, and the tube was pointed obliquely from below, upward and inward. In the other case, the tube was placed above the dislocated femur and pointed obliquely downward and inward. The advantage of the latter was that if the femur was extended it did not crowd upon the tube, and if the head of the femur dropped downward, the tube was not pressed away from the acetabulum. In all the cases the femur was kept in an adducted and flexed condition by means of a plaster-of-Paris bandage which included legs and thigh.

In the first case, this plaster-of-Paris bandage was used for two months; in the last case, this was removed after a shorter time.

It is manifest, as soon as the fixation bandage can be removed without discomfort to the patient, it is desirable to do so, as locomotion with crutches should be interfered with as little as possible.

The immediate results of these three operations were extremely satisfactory. There was a great improvement in the temperature, there was but little shock of the operation, the patient was relieved from sensitiveness and pain, and was able to be moved with much greater freedom than before. The result has been watched in two of these cases for some time. In one a year and a half, in the other a year. In the third, the result was not watched for longer than three months, as the patient was removed to a distance. In the two that were watched for a long time, a great improvement in the patients' conditions was noticeable. There was a marked increase of weight, and the patient was able to go about on crutches with freedom in the position of patients with a cured hip disease with a bad deformity. In both these cases it was necessary to retain the celluloid drainage tubes for a long period, applications being made by means of a tampon or injection to the diseased acetabulum. Otherwise, the deep

passage to the acetabulum became blocked by the muscles which on contraction stretched across the acetabulum. When it became evident that thoroughly healthy granulations covered the acetabulum and good drainage was secured, the drainage tubes were removed. It is manifest that nothing would be gained by small drainage tubes, as the secret of success lay in absolute drainage and the substitution of healthy granulation for unhealthy changes. In both of these instances the result proved that the procedure was a life-saving one, but in none of them has an attempt yet been made to replace the head into the acetabulum. In the case that was not followed longer than three months, the patient had improved greatly, enough to warrant the attempted treatment. The ultimate result is not known, and, as the patient had developed amyloid changes, the ultimate outcome is doubtful.

In regard to the correction of the deformity, two measures suggest themselves,—either an attempt at the reduction of the head of the femur into the cured acetabulum, which would be difficult if any change in the tissues had taken place, or correction of the deformity by subtrochanteric osteotomy. The latter promises a useful limb, provided the head is firmly established in its position of dislocation, which can reasonably be expected as the cicatrizing process progresses.

In the three cases in which this procedure was performed, the patients were young, varying from five to six years of age. It is manifest that the measures would be of less use in older patients without an active process of repair. It is uncertain in how many cases this method can be used, but, from the three in which it has been tried, the result appeared to prove that it was not dangerous, that it was preferable to the excision of the acetabulum, and less mutilating than amputation of the hip-joint.

Although the relief of the diseased acetabulum from the intra-articular pressure of the crowded head of the femur and the giving thorough drainage was attempted only in desperate cases by means of dislocation of the femur, it is possible

that this measure may be of use in less severe cases, when the relief of pressure is demanded more than acetabulum drainage.

Under these circumstances, the anterior incision and the forward dislocation of the head of the femur suggest themselves as of possible advantages in less advanced cases of acetabular disease.

CONTRIBUTION TO THE PATHOLOGY OF SUPRA-ACROMIAL DISLOCATION OF THE CLAVICLE AND OBTURATOR DISLOCATION OF THE HIP.

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A MAN, aged about forty years, was admitted shortly after having fallen from a considerable height. He was unconscious, and there was unmistakable evidence of a fracture of the base of the skull and contusion of the brain.

There was a fracture of the right clavicle at its middle third and dislocation of its outer end upward upon the acromion. There was a dislocation of the left hip forward and downward, the head of the femur resting opposite the thyroid foramen.

The dislocation of the hip was reduced by traction downward, forward, and outward in the axis of the femur, combined with direct pressure upon the head of the bone and the hip immobilized by a long side splint.

The acromioclavicular dislocation was corrected, and the over-riding of the fragments overcome by carrying the shoulder upward and outward. Death occurred at the expiration of ten hours.

Post-mortem examination was confined to dissections of the dislocated joints, as there was no peculiarity about the head injury.

I. Acromioclavicular joint.—The outer end of the clavicle rested by about one-half of an inch of its under surface upon the upper surface of the acromion corresponding to the articulation. The superior and inferior acromioclavicular ligaments were torn through: no interarticular fibrocartilage was found. The conoid

and trapezoid ligaments were both torn through at their attachment to the clavicle.

II. The hip-joint.—The head of the femur occupied the acetabulum.

There was no injury of any of the important vessels or nerves about the joint; the Y ligament was intact. There was a very moderate amount of extravasated blood among the adductor muscles and within the synovial sac.

There was an irregular, ragged rent, not of large size, in the capsule of the joint and in the lining synovial corresponding to the cotyloid notch and at the attachment of the capsule at this point. The hole in the capsule was approximately triangular and about three-fourths of an inch in length on each of its sides; that corresponding to the transverse ligament was relatively smooth, the others ragged and fringed. The round ligament was torn away from its point of attachment to the head of the femur.

The fibres of origin of the obturator externus were somewhat lacerated opposite the outer part of the obturator foramen. There was slight hæmorrhage into the upper part of the adductor magnus and very trifling laceration of its fibres. There was no injury of the pectineus.

While no new fact is here presented, the rarity of opportunity to make post-mortem dissections of dislocations of these joints seems to warrant the publication of the data obtained.

A CASE OF TRIGGER FINGERS.

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THE history of a case of this comparatively rare condition is as follows: Mrs. R., a Polish Jewess, aged fifty-seven years, called at the hospital for an opinion upon her affection, consisting of a sudden locking of the knuckle-joints of the second and third fingers of the left extremity. The hands are those of a laboring woman, coarse-grained and hard, with blunted finger-ends. The disability has lasted for over fifteen years and has been progressive. The woman's general health, however, has been always good, and she is the mother of a large family.

The condition is manifested in movements both of flexion and extension. Upon attempting to grasp an object, as, for example, a chair-back, with the left hand, the thumb, index, and little fingers will clasp naturally, but the ring and middle fingers, after describing about one-third of the arc of flexion, suddenly become locked at their metacarpophalangeal joints, and the woman is utterly unable to accomplish further movement of those fingers unaided. She has by long practice established a complementary action of her other hand, when, by pushing the affected fingers beyond the lock, an apparent dislodgement takes place almost audibly, and the woman is then able to hold the object or to clinch her hand. Movements of extension are carried out in a similar but reversed manner. Opening through the first third of the arc is entirely voluntary; during progress through the middle third absolute fixation takes place; aided by the other hand, release with a jerk is obtained, followed by full and easy straightening.

The affected fingers are of normal outline as compared with adjacent phalanges or with those of the other hand. Palpation reveals neither thickening of tendon nor of joint-sheath, there is

no sign of local inflammatory action having taken place. The woman's statement is that the restricted motion has gradually developed from no assignable cause, and that at no time has she experienced pain in the parts affected; this is uncommon, as most of the recorded cases report pain to be a constant factor.

The cause of trigger finger has been variously set down to rheumatism, gout, traumatism direct or in the form of a constant irritation, tenosynovitis, the presence of a "loose cartilage," or, according to Marcano, who stated that it was a constant cause, the existence of a nodular swelling in the flexor tendon itself producing the characteristic jerk by rubbing against the sesamoid bones or the tendinous sheath. The central nervous system has been said to be at fault in some cases of this condition. Work causing special fatigue of the hands has been set down as a cause by Schmidt. His cases, involving frequently a thumb and middle finger, occurred in seamstresses, knitters, and soldiers required to perform straining movements of the fingers in musket drill.

In Necker's examination of 121 cases, he found rheumatism either in the acute or chronic form to have been the cause in fifty-two; traumatism in thirteen; occupation in forty-seven; congenital in two cases, and in the remaining seven no cause was assignable.

The pathological condition present in trigger finger was claimed by Nélaton, one of the first observers, to be a thickening of the tendon sheath, but in later years his belief was that a foreign body caused the abnormality. According to Steinthal, displacement of the insertion of the lateral ligaments of the joint affected towards the palm was demonstrable in two cases of his dissection. In eleven cases of post-mortem examination where this condition was present thickening of the tendon or of its sheath had occurred.

The treatment of the condition varies from massage and the application of tincture of iodine, measures of confessed uselessness, to active surgical interference. In those cases where sesamoid enlargements or loose bodies in the joint are

demonstrable or discernible by means of the X-ray, incision into the parts affected is justifiable. Where chronic inflammation has caused organization of exudate, scarification with the cautery may be employed; but in a condition such as the case under notice, the woman being well on in years and scarcely handicapped, weighing the possibilities of ankylosed joints after operation with the present state, surgical interference does not seem to be indicated.

THE HARTLEY-KRAUSE FLAP IN HÆMORRHAGE FROM THE MIDDLE MENINGEAL ARTERY.

WITH REPORTS OF TWO CASES.[1]

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In 1891 and 1892, Hartley, of America, and Krause, of Germany, each working independently, devised a method of resecting the trigeminus nerve intracranially by means of an osteoplastic resection of the skull in the manner originated by Wagner. Hartley's first case was operated upon August 15, 1891 (or, as stated in his second article, August 8, 1891), and Krause's, February 23, 1892. Hartley's case was reported to the New York Surgical Society, January 13, 1892; Krause's to the German Surgical Society at its Twenty-First Congress in Berlin, June 10, 1892. Hartley's[1] case was published March 19, 1892, and Krause's,[2] October 11, 1892. Thus it is seen that, while Hartley's case was operated upon before Krause's, and also published before Krause's was published, Krause's case was operated upon before Hartley's case was published.

Hartley, in a second article on this subject in May, 1893,[3] claims priority for the operation, a claim which, I believe, is not disputed.

Hartley, in his first article, describes his flap as follows:

"An Omega-shaped incision was made, having its base at the zygoma and measuring a distance marked by a line drawn

[1] Read before the Chicago Surgical Society, May 5, 1902.

from the external angular process of the frontal bone to the tragus of the ear.

" The curved and rounded portion of this incision reached as high as the supratemporal ridge, the diameter of said circle being three inches. The skin and deeper tissues were cut in the shape of the Greek capital letter Omega. The incision was carried down to the periosteum of the skull in all portions of the incision except in the straight part at the base; the tissues were then retracted and the periosteum divided upon the bone in the same direction and as far as the straight part at the base.

" With a chisel a groove was cut in the bone corresponding to the divided periosteum. This groove went to the vitreous plate except at the upper angle over the rounded portion, where it included the vitreous plate.

"A periosteum elevator was here inserted and used as an elevator to snap the bone on a line between the ends of the circular portion of the incision. In this way the breakage occurs along the lower portion of the wound, and a flap, consisting of skin, muscle, periosteum, and bone, is thrown down, exposing the dura mater over a circular area of three inches in diameter."

In his second article,[4] Hartley says: "I do not find it necessary to complete the Omega cut, as the lower straight part of the Omega incision is unnecessary. The periosteal incision converges upon each extremity beneath the muscle-flap for about one-half a centimetre, so as to cause a cleavage in the bone when elevated. This part of the periosteal incision is made by retracting the skin and muscle-flap slightly upon each side. The point at which the periosteal incisions converge is just at the level of the zygoma."

Krause[5] describes his flap as follows: " The pedicle of the flap lies above the zygoma. The incision begins in front of the tragus, mounts upward bending convexly backward, and then describes an arch about semicircular in form, and proceeds forward, likewise convexly, to the malar bone, in such a manner that the base of this uterus-shaped flap is three and a quarter centimetres across, its height six and a half centimetres, its greatest width, lying above, five and a quarter centimetres."

It will be seen that this flap corresponds very closely to Hartley's.

Each of these writers intended his flap to be used for intracranial resection of the fifth nerve. However, Krause adds, in a foot-note to his article, "My incision serves well for the purpose of ligating the main trunk of the middle meningeal artery." Hartley, in the description of his first operation, says "the middle meningeal artery was tied," but says nothing of the use of his flap for the purpose of exposing the artery.

In an article by the writer,[6] giving the results of original investigations on the middle meningeal artery, one of the conclusions was as follows: "That we have in the Hartley-Krause osteoplastic flap the only method fulfilling all the requirements for an ideal exposure of the middle meningeal artery and its branches." Although this conclusion was based solely upon my own researches, it was by no means an original conclusion, since Steiner,[7] in 1894, concludes that this method is of so great superiority that we now have no use for the more defined locations of other methods except where some contraindication to the formation of the flap is present. These contraindications he names as the presence of a compound fracture or great injury to the soft parts.

The method was tested by Steiner as well as by myself upon the cadaver, and the conclusion in each case was based upon anatomical rather than practical surgical considerations. In every case the main trunk and anterior and posterior branches were rendered accessible.

To Krönlein[8] we owe much for classifying the hæmatomata resulting from rupture of the middle meningeal artery or its branches according to their anatomical locations, and for pointing out definitely the objects to be accomplished in exposing the interior of the cranium in case of such arterial rupture.

Krönlein divides all extradural hæmatomata originating in rupture of the middle meningeal artery or its branches into I. Diffuse and II. Circumscribed.

Of the diffuse hæmatomata he says: "They are of great extent, covering almost the entire concavity of the affected area of the cranium."

Of the circumscribed he says: "They can be extensive, but one part of the dura mater is always adherent to the concavity of the skull. These hæmatomata have a sharp border, and are generally oval or circular in outline, their greatest thickness corresponding rather exactly to the centre."

He subdivides the circumscribed hæmatomata into three anatomical groups:

1. Hæmatoma medium, or temporoparietal.
2. Hæmatoma posticum, or parieto-occipital.
3. Hæmatoma anticum, or frontotemporal.

Of these three the hæmatoma medium is by far the most frequent. This occupies the middle fossa of the skull, and is generally bounded anteriorly by the lesser wing of the sphenoid, posteriorly by the petrous portion of the temporal bone, reaching inferiorly to near the foramen spinosum and superiorly to, or frequently beyond, the squamous suture. The greater frequency of this group is accounted for by the greater vulnerability of the temporal region and the richness of vessels, this region including the main trunk and anterior and posterior branches.

The hæmatoma posticum is decidedly rarer. This occupies the region below the parietal eminence, leaving the middle fossa quite free, and reaching generally to the falx cerebri above, to the occipital protuberance behind, and to the tentorium cerebelli below.

The hæmatoma anticum is the rarest of the three. This occupies principally the region of the frontal eminence, separating part of the dura mater from the orbital plate below, and extending posteriorly to or beyond the anterior inferior angle of the parietal bone.

As to the objects to be accomplished in exposing the site of the hæmatoma, Krönlein says: "We have to do, in the first place, not with checking hæmorrhage, but with the removal of the extravasation which is already present and is dangerous. In cases of difficult diagnosis the hæmorrhage has generally ceased at the time of operation." In a second article[9] he emphasizes the judgment that the position of the

hæmatoma and not the anatomical position of the middle meningeal artery must decide the site for opening the skull.

Wiesmann [10] agrees with Krönlein that the removal of the clot is of prime importance.

In regard to ligation in continuity of the artery in the place of election, Krönlein, in his first article says: "It might promise, in case the hæmorrhage continued, only a doubtful result, if the vessel lesion lay immediately peripherally in the anterior branch." In his second article he says: "It could be of value only when the artery happened to be ruptured in the place of exposure and both ends could be tied. This would be really not a ligation in continuity, but a ligation in *loco læsionis*. In all other cases the ligation in continuity has no value. As I showed in 1882 (Wiesmann's [29] Case No. 10), a divided middle meningeal artery bleeds from both ends, so that its ligation in continuity could promise no absolute success."

Wiesmann [10] deals curtly with the question of ligation in continuity: "There is no sense in ligating in continuity in the place of election after trephining."

We cannot but agree with these authorities that our first and most important, oftentimes our sole, object in opening the skull is the removal of the clot which by its pressure is threatening the patient's life. The question of the site of operation, then, must rest upon practical surgical considerations rather than upon anatomical; in other words, it is the position of the clot rather than the location of the artery that must guide us. Practically, the exposure and removal of the clot leads naturally to the discovery of the arterial lesion, so that the artery can be secured, if still bleeding. Wiesmann [11] notes that frequently the centre of the convexity of the clot corresponds rather closely to the site of rupture of the artery.

When, then, can the clot most certainly be reached? Krönlein,[12] in his first article, recommends that where there is no sign of value on the skull or its coverings, as a routine practice we trephine first in the temporal region at about the anterior inferior angle of the parietal bone; in other words,

at the location of choice for the ligation of the middle meningeal artery. Here we, as a rule, reach the anterior branch. His reason for choosing this site he states as follows: "We can, almost without exception, succeed in finding here the diffuse hæmatoma, and the circumscribed temporoparietal and frontotemporal. Only the circumscribed parieto-occipital hæmatoma cannot be reached from this place."

If, then, feeling sure of the diagnosis, the surgeon fails to expose the hæmatoma by trephining in the temporal region, he must assume that he has to do with a circumscribed parieto-occipital hæmatoma. In such a case Krönlein recommends that the surgeon proceeds to a second trephining under the parietal eminence.

In his second article, Krönlein [13] modifies his advice slightly, advising that the choice as to which place to trephine first and whether to combine one trephining operation with another, and, in such a case, in what order, must be decided by exact observation of the patient before and during the operation.

In this article he reports a case where he trephined primarily below the parietal eminence. He was led to do so through having an accurate statement that the patient struck the back of his head on a beer-barrel, and by finding a slight suggillation a little to the left of the middle line in the occipital region. In this case the clot was exposed immediately at the trephine opening, but was not entirely removed, as it extended so far towards the base as to be out of reach. The patient did not regain consciousness, and developed a bronchopneumonia which was the immediate cause of death. The autopsy showed that the hæmatoma extended to within 1.5 centimetres of the foramen magnum. Krönlein recommends that in such a case an additional trephine opening should be made in the occipital region, somewhat behind the mastoid process in the middle of the inferior curved line of the occipital bone.

How accurate a localizing diagnosis is possible? Sir Astley Cooper [14] said: "I do not find any difference of symp-

toms produced by the different situations of the blood; whatever is the situation of the blood, the symptom of compression is the same."

Wiesmann,[15] however, points out a number of localizing symptoms which may be observed at times. Thus, an isolated paralysis of the opposite arm would point to the middle part of the central convolutions as the seat of the lesion; an isolated or very strongly marked facial paralysis points to an extravasation low down anteriorly. Unilateral disturbances of sensibility point with great probability to a hæmatoma posticum. Aphasia, a rare symptom, is due to pressure on Broca's convolution on the left side, and points to a hæmatoma anticum or a very large hæmatoma medium. The pupillary symptoms are very variable, but when they differ on the two sides, the dilated pupil is on the affected side in the majority of cases, but not invariably. Choked disk, if present, is on the side of the lesion. Disturbances of innervation of the eye-muscles are generally due to direct lesion or pressure within the cranial cavity, and so may assist in localizing the lesion.

Unfortunately, it is only exceptionally that findings leading to an accurate topical diagnosis are demonstrable. Krönlein[16] says: "If the surgeon could see the case from the time of injury and follow the development of symptoms, and if the case were not complicated by concussion of the brain, contusion of the brain, apoplectic foci in the brain-substance or acute alcoholism, then we could hope for more in the direction of topical diagnosis. But how seldom are all these conditions fulfilled! In complicated cases without history the surgeon is glad to make a diagnosis in general, or to know on which side to trephine. We think that in the preponderating majority of cases a further refinement of diagnosis cannot be thought of."

In his second article, Krönlein[17] says: "In closed skull coverings we have only the brain symptoms to lead to a diagnosis, and we are generally lucky if we can tell upon which side the lesion is. Sometimes we can go a step farther and make a probable diagnosis of the location of the hæmatoma

in a certain region. When this is accomplished, it is all that we can do in the way of exact diagnosis."

The most important help in deciding upon which side the lesion lies is the gradually appearing hemiplegia, which may be preceded first by spasms, then by paresis. Difficulty in deciding which is the paralyzed side arises in cases of deep coma. It is claimed by some observers that instead of the usual paralysis of the side opposite the lesion, the so-called contralateral hemiplegia, we may have paralysis of the same side as that of the lesion, the so-called collateral hemiplegia. Oppenheim (quoted by Wiesmann [18]) looks upon these cases with suspicion as to the accuracy of the observations.

It appears, then, that in the great majority of cases we can determine upon which side the lesion is, and nothing further as to its location; also, that the great majority of the hæmatomata can be reached by opening the skull in the temporal region at about the anterior inferior angle in the parietal bone. Hence, it is seen that the best site for opening the skull, based upon practical surgical considerations, coincides with that best adapted for reaching the anterior branch of the middle meningeal artery, based upon anatomical considerations.

In my former article [19] I said: "I regard the (Hartley-Krause) osteoplastic flap as the ideal method of reaching the middle meningeal artery, for by it the removal of the clot, which is generally present when this operation is done, is facilitated, and the artery can be ligated in the most desirable location." On the strength of Krönlein's practical deductions, I wish here to reaffirm and emphasize this statement, since by this method we expose the temporal region better than by any other.

An advantage of the osteoplastic flap which has not been alluded to is that it leaves no bony defect. At the time of operation the dura is removed some distance from the inner surface of the cranium by the presence of the clot. Upon removal of the clot the brain does not at once expand and press the dura back into its normal position; sometimes this process

requires several days. As a consequence of this, portions of bone removed by the trephine, chisel, or rongeur forceps cannot be replaced, as there is nothing to support them from beneath. The bone in the osteoplastic flap, on the contrary, can easily be made to resume and retain its normal position.

Krönlein says that a trephine opening in the temporal region will not expose a hæmatoma posticum. In Fig. 2 I have outlined the flap upon Krönlein's diagram of the three hæmatomata, and it will be seen that its posterior superior border touches the edge of the hæmatoma posticum. Of course, this hæmatoma has no definite limits; but if it is of comparatively large size and extends pretty well forward, its anterior edge will be exposed at the posterior superior border of the flap, as shown in my second case, here reported. If no hæmatoma is exposed, upon turning down the flap, the opening may be enlarged towards the parietal eminence, or the hæmatoma posticum may be sought for by a trephine opening in that region, as Krönlein suggests.

The cases in which no clot is present in case of torn middle meningeal artery are, first, those rare ones mentioned by Wiesmann [20] in which the artery does not bleed, and, second, those in which there is a compound fracture which permits the blood to escape externally.

The artery is always found beneath the clot, adhering to the dura. Hartley [21] called attention to this adherence of the artery to the dura, as did also the writer,[22] who demonstrated a process of the dura covering the outer surface of the artery, causing a firm adherence between these two structures, and inferred "that in cases of extradural hæmorrhage the artery would be found beneath the clot in all cases."

So far as I know, every observation, operative or post-mortem, in cases of extradural hæmorrhage has borne out the correctness of this inference. A possible exception can be imagined where the artery might be "held in contact with the bone by running in a canal."

In a considerable percentage of cases, 60 per cent. according to my findings,[23] 38 per cent. according to Steiner,[24] the

artery runs for a short distance at the anterior inferior angle of the parietal bone in a bony canal, and in such cases it is ruptured in turning down the flap. This, however, as pointed out by Hartley and the writer, is not of serious moment, as the ruptured end is in full view and easily secured.

The earliest recorded case which I can find of osteoplastic resection of the skull for intracranial hæmorrhage was reported by Stenzel.[25] The flap he describes as follows: "A pedicled flap three to four centimetres in diameter was made beginning three centimetres back of the external angular process of the frontal bone." Thus it is seen that his flap, while exposing the same region as the Hartley-Krause flap, was smaller than the latter. This exposed the extravasation, which lay somewhat below and behind. Clot removed with the fingers; hæmorrhage began again; source could not be found. Iodoform gauze packing. Recovery.

It is not certain that this was a hemorrhage from the middle meningeal artery. Stenzel's diagnosis was "hæmorrhage following fracture of the base."

In discussing this case, Krause said: "For ligating the main trunk of the middle meningeal artery, I recommend the same flap which I proposed for trigeminus resection."

Steiner[26] says that in 1893 Wölfler used the osteoplastic flap for middle meningeal hæmorrhage, and in a second case used a flap five centimetres broad and eight centimetres high.

Wiesmann[27] says that Nasse also used the osteoplastic flap for middle meningeal hæmorrhage.

CASE I.—*Rupture of Right Middle Meningeal Artery, Anterior Branch; Subcutaneous Fracture of Squamous Portion of Temporal Bone and of Base of Skull; Compression of Brain; Hæmatoma Medium; Hæmorrhage into Fourth Ventricle; Free Interval; Contralateral Hemiplegia preceded by Spasms; Osteoplastic Resection of Skull; Removal of Clot; Ligation of Ruptured Artery; Death Ten Hours after Injury.* Ante-mortem temperature, 107° F.; post-mortem, 109.5° F.

P. G.; aged thirty-five years; male. On February 3, 1899, fell through a trap-door, striking his head upon the wooden

floor about twenty feet below. Did not become immediately unconscious. Was put in a patrol-wagon, and was seen on his way home by a physician, who found no apparent serious condition present. About an hour after the injury he became unconscious. Shortly afterwards he was seen by Dr. Guy Gowen, who sent him to Wesley Hospital. When seen by Dr. Gowen he had spasms in the left upper extremity, which were soon followed by paralysis of that member.

When seen by the writer at the hospital five hours after the injury he presented all the cardinal symptoms of middle meningeal hæmorrhage, compression-pulse, stertorous breathing, left hemiplegias, with history of a free interval and spasms preceding the hemiplegia. In the right temporal region was a slight doughy swelling. Pupils equal, medium dilatation. Temperature, 101.5° F.

Diagnosis before operation, hæmorrhage from right middle meningeal artery, compression of brain, with probable fracture of skull in temporal region.

Operation five hours after injury. Hartley-Krause osteoplastic flap made on the right side. A hæmatoma was found in the temporal muscle. In cutting through the bone, the Devilbiss forceps, which acts upon the same principle as the Stille forceps, was used. The squamous portion of the temporal bone showed a linear fracture. Upon turning down the flap a hæmatoma medium was found. After removal of the clot, the proximal end of the ruptured anterior branch of the middle meningeal artery was seen to be bleeding freely and was ligated. It was now seen that the fracture extended to the base of the skull. Soon after the operation was begun, the rectal temperature of the patient was found to be 104° F., and this continued to rise rapidly, so that at the close of the operation it was 107° F. The removal of the clot caused no change in the condition of the patient, which steadily grew worse. The dura remained depressed, and a fractured portion of the bone of the flap, which had but poor connection with the soft parts, was removed. Wound closed.

Three hours after the close of the operation the patient died. The post-mortem temperature was 109.5° F.

Operative Diagnosis.—Rupture of the anterior branch of the right middle meningeal artery; hæmatoma medium; compression

of brain; fracture of skull in temporal region; fracture of base of skull.

Autopsy.—Six hours after death I had the privilege of examining the skull and its contents. There had been no further hæmorrhage from the middle meningeal artery. The fracture extended across the squamous portion of the right temporal bone, across the great wing of the sphenoid on the right side, through the body of the sphenoid and into the great wing of the sphenoid on the left side. In the fourth ventricle was found a clot almost one-half centimetre in diameter.

Post-Mortem Diagnosis.—Same as operative diagnosis, with the addition of hæmorrhage into the fourth ventricle.

Immediate cause of death, hæmorrhage into the fourth ventricle.

CASE II.—*Subcutaneous Linear Fracture of Parietal Bone above Right Parietal Eminence; Rupture of Several Small Branches of Middle Meningeal Artery in this Location; Concussion of the Brain; Compression of the Brain; Hæmatoma Posticum; Partially Free Interval; Contralateral Hemiparesis; Osteoplastic Resection of Skull, with Enlargement of the Opening Upward and Backward; Removal of Clot; Iodoform Gauze Packing; Recovery.*

J. K.; aged thirty years; male; horse-shoer. Family history negative. Previous health good. On August 11, 1901, at about 5.30 P.M., while slightly under the influence of liquor, fell from a balcony, a distance of eight and a half feet, striking his head upon a concrete pavement. Became immediately unconscious, and was taken to Wesley Hospital twenty minutes after the reception of the injury. Was totally unconscious when he entered the hospital, but three-quarters of an hour after the injury he became partially conscious and could answer questions. The period of semiconsciousness was short, and he gradually lapsed into complete unconsciousness. At the same time paresis of left arm and leg developed, and the pulse gradually lowered. At 6.15 P.M. the pulse was 82 per minute; at 7.30 P.M., 64, and at 10.30 P.M., 52. It was the characteristic full, compression pulse. Pupils equal, medium dilatation. No fracture could be discovered; no wound or contusion of soft parts.

Diagnosis before operation, hæmorrhage from right middle meningeal artery; compression of the brain.

Operation six hours after injury. No sign of injury to the scalp. Hartley-Krause osteoplastic flap made on the right side, as in Case I. No injury to the bone found in this neighborhood. Upon turning down the flap, the anterior branch of the artery, which was in a bony canal on the flap, was ruptured and ligated. At the upper posterior part of the exposed area was seen the edge of a hæmatoma. An incision through the soft parts was now made upward and backward two and a half inches, beginning at the upper posterior margin of the flap. This brought to view a linear fracture of the parietal bone two inches long, running parallel with the sagittal suture and lying one and a half inches below the suture. No depression. With the Devilbiss forceps a portion of bone one to one and a half inches wide was removed throughout the entire length of the incision through the soft parts, its upper posterior extremity being above and a little behind the parietal eminence, and reaching to within one and a half inches of the sagittal suture. This exposed the hæmatoma thoroughly, and the clot was removed with the fingers and the sharp spoon. A number of small branches of the middle meningeal artery were found bleeding beneath the side of the fracture. The dura was intact. Iodoform gauze packing. Weight of clot, two and a half ounces. The portion of bone removed from the parietal region was not replaced.

Operative Diagnosis.—Subcutaneous linear fracture, without depression, of right parietal bone above parietal eminence. Laceration of several small branches of the middle meningeal artery. Hæmatoma posticum. Compression of the brain.

Postoperative History. — Pulse at the close of operation, 122. Two and one-half hours after the operation he answered questions and moved his left leg; pulse, 132; axillary temperature, 100° F. Four and one-half hours after the operation he was fully conscious. The highest temperature was twenty-four hours after the operation, 100.8° F. in the axilla. On the fourth day the temperature became normal and remained so. The pulse became normal on the third day. Thirty hours after the operation the outside dressings were removed, being saturated with blood and serum. Fifty-six hours after the operation the gauze packing was removed, and fresh packing was inserted in greatly lessened amount. The wound was aseptic. Five days after the operation all packing was removed permanently, the dura now

being everywhere returned to its normal position. For four days the patient had to be catheterized. His progress after the fifth day was uneventful.

Present Condition.—He has been working steadily at his trade of horse-shoeing, but says he occasionally has pain in the scar when he stoops over at his work. The cold also makes the scar smart. The anæsthesia which at first was noticed in the scalp above the scar has disappeared. He has no headache, no vertigo, no periods of unconsciousness. The scar shows the height of the flap to be three inches, and its greatest breadth three and one-half inches.

These two cases confirm Krönlein's [28] observation that the result of operation for hæmatoma arising from middle meningeal hæmorrhage is generally favorable unless compromised by simultaneous injuries resulting from the same cause as the hæmorrhage. In Case I, if the extradural hæmatoma had been the only trouble, recovery could have been looked for, but the patient died from the concomitant hæmorrhage into the fourth ventricle. The second case, being uncomplicated, recovered.

Wiesmann [29] reports several cases of extremely high temperature in hæmatoma from the middle meningeal artery. In several of the cases this was due to intercurrent causes, as erysipelas and bronchopneumonia. In others, the decomposition of the clot, where this had not been removed, accounts for it. The cases similar to Case I, in which the temperature rises to an extreme height in a few hours after the injury, he regards as not yet satisfactorily explained, not accepting as proven the theory of direct irritation of the heat-regulating centre.

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TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, May 14, 1902.

The President, LUCIUS W. HOTCHKISS, M.D., in the Chair.

INTRAPERITONEAL RUPTURE OF THE BLADDER.

DR. JOSEPH A. BLAKE presented a man, thirty-four years of age, who was admitted to Roosevelt Hospital during the evening of January 20, 1902, in extreme shock, with a dorsum ilii dislocation of the left femur, which was reduced by the house surgeon under nitrous oxide anæsthesia.

During the night he developed symptoms referable to an intraperitoneal rupture of the bladder, and when first seen by Dr. Blake, the next morning, there were unmistakable evidences of peritoneal irritation and effusion. Catheterization brought away a small amount of bloody urine. Immediate operation revealed an intraperitoneal rupture of the bladder, three inches long, with about twenty-one ounces of urine in the peritoneal cavity. The mucosa and muscularis were sutured with catgut, and two rows of catgut Lembert sutures were superimposed. There was a considerable collection of blood in the prevesical space, and a rupture of the anterior ligaments of the bladder, which contraindicated suprapubic drainage of that organ. A urethral discharge also contraindicated catheterization, so perineal drainage was instituted. Evidences of a fracture of the acetabulum were present, namely, crepitus on movements of the hip, while the femur was evidently uninjured. Convalescence

was uneventful, and he left the hospital against advice on the twenty-third day with a plaster splint. This he removed, and returned with a relapse of the dislocation March 4, 1902. This was reduced by manipulation with great difficulty, there being a marked tendency to spontaneous relapse, the acetabulum seeming to be more or less obliterated. After reduction, complete extension was impossible, apparently from the filling of the acetabulum with exudate. He was kept in plaster in bed for five weeks and discharged at the end of six weeks with crutches.

At present he has no shortening, there is considerable thickening about the hip-joint, and there is flexion of about twenty degrees. Extension and rotation out are much limited. Flexion and adduction are free. Apparently there is not complete reduction, owing to probable bony exudate in the cotyloid cavity. Limitation of flexion and rotation seem to be due to the tension of the Y ligament.

He is not as yet able to bear his weight on the limb, but there seems to be no tendency to relapse. He has also developed crutch palsy of the right musculospiral.

DR. ROYAL WHITMAN called attention to the fact that the patient had a paralysis of the dorsal flexors of the foot on the injured side and a double crutch paralysis. He suggested, as a substitute for the crutches, a short spica bandage and a foot brace. The final result, as far as the function of the hip was concerned, would be very good, he thought.

FRACTURE OF THE SURGICAL NECK OF THE HUMERUS AND MIDDLE THIRD OF THE FEMUR.

DR. BLAKE presented a boy, thirteen years old, who was admitted to Roosevelt Hospital on March 14, 1902, with a fracture of the surgical neck of the right humerus and of the middle third of the right femur. The X-ray showed that the lower fragment was drawn up on the outer side of the upper, causing a lap of about one and one-quarter inches. Three ineffectual attempts at reduction of the fracture of the humerus having been made under anæsthesia, Dr. Blake cut down upon it on the fifteenth day, and found the tendon of the pectoralis major caught between the fragments in such a way as to prevent reduction unless by

direct instrumental interference. Reduction and suture with chromic gut and complete union in five weeks without deformity.

DUODENAL ULCER, WITH PERFORATION.

DR. BLAKE presented a man, twenty-five years old, who was admitted to Roosevelt Hospital on April 7, 1902. Five years before he first had an attack of abdominal pain which lasted about a week. Has since had an attack of similar character about once a year, accompanied with vomiting, nausea, and gastric disturbances. Two weeks ago there began a similar attack to those previously experienced; gastric disturbances, nausea, vomiting, hyperacidity, flatulence, and pain in region of umbilicus. Bowels constipated; two days before admission pain became very severe, tearing in character, localized at umbilicus, and then general abdominal; no vomiting; abdominal tenderness acute, and great prostration.

On admission his temperature was 100.6° F.; pulse, 88; respirations, 32. He displayed pallor, great prostration, cold, clammy skin, and great pain increased on slightest movement. The pulse was full and regular.

The abdomen evidenced distention, rigidity, and general tenderness most marked over right rectus opposite umbilicus, tympany, dulness in flanks.

One and one-half hours after admission,—under nitrous oxide, ether anæsthesia,—the abdomen was opened by an incision in the right linea semilunaris, three inches long. The abdomen contained abundant white purulent fluid. Intestinal coils distended and injected. Appendix normal. An incision was then made in the linea alba from just below ensiform to one and one-half inches below umbilicus. Inasmuch as the distention of the intestines was so marked, evisceration was performed. Pus was present everywhere except on the anterior surface of the stomach and the region of the spleen. The pelvis was full of pus. The gall-bladder was normal. Attention being diverted from the stomach by the absence of effusion about it, the intestines were run over rapidly for perforation, which was finally found in the duodenum just at the pylorus. The perforation was covered with lymph, and, as there appeared to be no gross perforation and no escape of intestinal contents, its size was not determined.

About it there was marked induration of the intestinal wall. It was rapidly turned in with two rows of catgut Lembert sutures. The whole abdominal cavity was then washed out and dried. Inasmuch as the intestines were so distended as to prevent their return, the jejunum was opened and evacuated, and closed after introducing an ounce of magnesium sulphate. The pelvis was drained through the lateral wound and the region below the liver through a stab wound in the right lumbar region. Shock was combated with stimulants and rectal saline enemata. There was vomiting of intestinal fluid for twenty-four hours. Distention disappeared on the third day. Temperature varied between 100° and 101° F., gradually becoming normal at the end of the second week. The median wound healed *per primam*. The drainage wounds were practically healed at the end of four weeks. During his convalescence he had at one time vomiting and epigastric pain, which disappeared in a few days. Bacteriological examination of the abdominal exudate revealed the Bacillus proteus in pure culture.

Dr. William B. Coley said that about a year ago he did a gastro-enterostomy in a case of duodenal ulcer which had caused frequent and repeated hæmorrhages, but did not rupture. The patient has remained perfectly well since the operation, and has gained about thirty pounds in weight. He was presented at one of the meetings of the Society five months after his recovery.

CONGENITAL DISLOCATION OF THE HIP.

Dr. Royal Whitman presented a boy, twelve years of age, who illustrated the later effect of congenital dislocation of the hip. There were now three inches of shortening on the affected side and a very marked lump. In nearly all these cases, the speaker said, prolonged use of the limb induces discomfort, and the disability and deformity, which are not, as in females, concealed by the skirts, are very evident.

In reply to a question as to how he intended to treat this case, Dr. Whitman said that the outlook for congenital dislocation at this age was not very encouraging. If operative replacement were to be undertaken, the patient should be placed in bed for a month, with from twenty to forty pounds of extension, with perineal counter-extension as a preliminary treatment.

SUTURE OF A FRACTURED OLECRANON, WITH SUBSEQUENT REMOVAL OF A FOREIGN BODY FROM THE ELBOW-JOINT.

DR. GEORGE E. BREWER presented a man, thirty-eight years of age, who was admitted to Roosevelt Hospital in August, 1901, suffering from a fracture of the olecranon process. There was considerable swelling about the elbow, pain on motion, and a distinct separation of the fragments, which could be readily felt beneath the skin. A straight splint was applied and ice-bags to the region of the elbow. At the end of ten days under chloroform anæsthesia an incision was made over the olecranon process. The bone was found to be fractured near its junction with the ulna, the two fragments being separated for a distance of about three-quarters of an inch. On flexing the elbow, the separation was considerably increased, exposing the interior of the joint, which contained a certain amount of synovial fluid and considerable clotted blood. The joint cavity was irrigated with sterile salt solution, and the fractured ends of the bone united by a single chromicized catgut suture; the cutaneous wound was then closed by interrupted sutures without drainage and a starch bandage applied, the arm being in the extended position.

The first dressing was on the tenth day, when the wound was found to be united. Passive motion was begun at the end of two weeks and continued, gradually increasing the amount of flexion until the end of six weeks, when he was discharged from the hospital.

About two weeks after his discharge he was readmitted. He stated that the night before he had fallen out of bed and again injured the elbow. On examination there was no evidence of separation of the fragments, but there were found partial dislocation of the radius and an inability to flex the arm beyond the right angle. All efforts at reduction were unsuccessful, and an exploratory arthrotomy was advised for purposes of diagnosis and treatment. Under chloroform anæsthesia an incision was made about three inches in length over the head of the radius, and the tissues divided until the joint cavity was opened. There was found to be a rupture of the orbicular ligament, and the cause of the failure to effect reduction was found to be the presence of a loose cartilage in the joint immediately behind the head

of the dislocated radius. This was removed, after which the head of the radius was easily reduced, a catgut suture placed in the torn ligament, and the joint closed without drainage.

After suture of the skin the arm was dressed at a right angle and held in this position by a starch bandage. His recovery from the operation was uneventful, and he was discharged from the hospital with a fair degree of motion at the elbow-joint. Since that time he has reported on numerous occasions, each time showing improvement in the motions at the elbow and an increasing strength in the muscles of the arm. At present, flexion, pronation, and supination are apparently perfect, but the arm cannot be extended to more than 170 degrees.

STAB WOUND OF THE ABDOMEN PENETRATING THE STOMACH.

Dr. Brewer presented a man, aged twenty-three years, who was admitted to the first surgical division of the Roosevelt Hospital in July last, suffering from the results of a wound in the abdomen received in a fight. On admission he presented the evidences of moderate shock. There were pallor, coldness of the extremities, subnormal temperature, and moderate perspiration. There had been vomiting, the pulse was rapid and somewhat feeble. On examination there was found a wound about three-quarters of an inch in length situated in the epigastric region, about two inches above the umbilicus and one inch to the left of the median line. There was no distention and no evidence of free fluid in the peritoneal cavity. He was immediately prepared for operation, and under chloroform anæsthesia a median incision was made extending from the ensiform to a point one inch below the umbilicus. On opening the peritoneal cavity there was escape of bright blood and gas. The stomach was first examined, and in its anterior wall was found a wound nearly an inch in length, between the sides of which the mucous membrane had prolapsed. There was a certain amount of undigested food in the immediate vicinity of the wound and considerable clotted blood. The wound was united by two layers of Lembert sutures. The omentum and transverse colon were next drawn through the wound and an incision made in the transverse mesocolon opening the lesser peritoneal sac. Through this wound the posterior surface of the

stomach was thoroughly examined and found to be intact. Intestines were then removed from the abdominal cavity and thoroughly inspected for other wounds. As none were found, the intestines and entire peritoneal cavity were irrigated with a large volume of hot salt solution. The intestines were returned and the wound closed by interrupted through-and-through silkworm-gut sutures. There was practically no reaction following the operation, although it was necessary to infuse the patient before sending him back to the ward. No food was administered for forty-eight hours, after which liquids were given, and at the end of eight days semisolids were allowed. The recovery was uneventful.

Dr. Coley said that in his opinion drainage should be employed in most cases of penetrating wounds of the abdomen, especially if the operation is done some hours after the receipt of the injury. In the January (1902) number of the Annals of Surgery, Fenner, of New Orleans, reports a series of six cases, all of which were operated on one or three hours after the wound was inflicted, and all recovered. It is true that drainage was used in only one case.

Dr. Hotchkiss said he thought the statement of Dr. Coley, that all cases should be drained, a little too broad perhaps, for in his own case of perforating ulcer of the stomach, operated upon after a lapse of sixty hours, the abdominal wound had been closed without drainage, and the patient had recovered.

OPERATION FOR SADDLE-BACK NOSE.

Dr. Arthur L. Fisk presented a young woman who, when she was five years old, met with an accident, injuring the nasal bones and resulting in a typical saddle-back nose. To remedy the deformity, she was operated on twice in Germany, with only partial success.

When she came under Dr. Fisk's care in February, 1901, he did not regard it as a favorable case for further operative measures. He finally decided, however, to put in an artificial bridge of celluloid. This was done in October, but it was not adjusted properly and caused the patient considerable pain. A month later he made a plaster cast of the nose, and had a celluloid bridge modelled upon it. The old bridge was then removed from the patient's nose and the new one inserted.

The patient had a number of disfiguring scars left from her operations in Germany. The appearance of these was much improved by the administration of potassium iodide.

SARCOMATA OF LONG BONES.

Dr. John B. Walker read a paper with the above title.

Dr. Coley spoke of the grave prognosis in these cases, especially of sarcoma of the femur. He has observed fifteen cases of sarcoma of the femur, and, so far as he has been able to trace them, only one is alive at the present time. That was a case of sarcoma of the lower end of the bone, in which amputation was done by Dr. Rushmore, and the patient was alive at least three years after the operation. Dr. Coley said he had performed hip-joint amputation for sarcoma six times, and these patients were either dead or had a recurrence. In one case of periosteal sarcoma he operated below the trochanter; the patient remained well for eighteen months, and then had a recurrence in the sciatic nerve. In another case of hip-joint amputation for sarcoma of the femur, by Dr. Robinson, of Danville, Va., there was a recurrence in the stump. Shortly after operation, a course of toxin treatment was instituted; he remained well for three years, and then had a recurrence in the iliac fossa; this again disappeared under the toxin treatment, and there has been no further recurrence up to the present time. Drs. Gerster and Lilienthal had a case in which the patient was accidentally inoculated with the germs of erysipelas, producing a disappearance of the sarcoma, and the patient is still alive after five years.

Dr. Coley said that his cases of sarcoma of the tibia, six in number, were all dead with one exception, and this was treated by the erysipelas toxins without operation. At the time Gross collected his statistics of cases of sarcomata of the long bones, his percentage of cures after three years were better than those we can show at the present day; this is possibly due to the fact that suppuration following operation was quite a common occurrence, and the infection may have influenced the disease beneficially. Dr. J. A. Wyeth is strongly in favor of producing streptococcic infection in these cases, without waiting for a recurrence.

As to the wisdom of an exploratory incision in these cases, the speaker said that up to a few years ago he believed in it and

practised it uniformly, but a study of his cases convinced him that it was not altogether a safe procedure. It is probable that in many cases a generalization of the disease is due to this free incision of a vascular tumor for diagnostic purposes. Infected cells may thus be carried to distant parts. His present plan in operating upon doubtful tumors of the femur is to prepare for a hip-joint amputation and have the patient understand that that amputation may be necessary. Then, when the Esmarch bandage has been applied and every preparation made for a high amputation, an incision is made into the tumor; its gross appearance will usually convince us as to its character; but if we are still in doubt, a frozen section should at once be made.

Dr. Coley said he has under observation at the present time a boy of fifteen with a typical sarcoma of the left femur involving two-thirds of the shaft of the bone. Amputation at the hip was strongly urged, but refused. The X-ray treatment was thereupon resorted to, and has been applied about three or four times weekly during the past three months. During that time the femur has diminished one inch in size, and there has been a slight increase in body weight.

Dr. Fisk said he has had four cases of sarcoma of the long bones. Three of them, which were reported in a paper read before the Hospital Graduates' Club in 1898, are dead. The other case was one of sarcoma of the head of the fibula; it was shown at a meeting of the Surgical Society about a year ago.

Dr. Fisk said he was rather surprised to hear that Dr. Walker advised treating these cases by excision and enucleation. Most of the authorities favored amputation beyond the affected bone. In regard to the more favorable outcome of these cases in former years, to which Dr. Coley had referred, Sutton attributes the apparent difference in the statistics to a possible error in the diagnosis of the earlier cases.

Dr. Brewer reported a case of sarcoma of the fibula with a rather peculiar history. The patient was a boy about twelve years of age who, when he first came under observation, had a small epulis of the lower jaw, which was removed by taking out a section of the bone. Four or five months later he developed a swelling of the left leg, about the size of a hen's egg, which the X-ray showed to be an expanded fibula. An exploratory incision revealed a sarcomatous mass covered by a thin shell of bone. The

leg was amputated at the knee-joint. The operation was done three years ago, and the boy has remained perfectly well. The pathologist reported that the sarcoma was of the medullary variety, made up of a mixture of spindle and large giant cells, and not very malignant.

DR. COLEY referred to a case of sarcoma of the tibia where amputation had been advised and refused. The growth subsequently disappeared under the toxin treatment, and the patient has been free from any signs of a recurrence since, a period of between three and four years.

DR. A. J. MCCOSH said the pathology of sarcomata was in a rather unsatisfactory state, and the probability was that in the course of a few years we will be compelled to revise our classification of this variety of malignant growths. At the present time, the pathological reports of the various types of sarcoma are, as far as prognosis is concerned, confusing.

About seven or eight years ago, the speaker said, he had a case of small, round-celled sarcoma of the head of the humerus. He amputated at the shoulder, enucleating the humerus, and then found that the glenoid cavity and upper end of the acromion process were involved in a mass about the size of a hen's egg. The patient refused to submit to further operative measures, and a very unfavorable prognosis was given. Since then eight years have elapsed and the patient is perfectly well to-day. Dr. McCosh said he could recall half a dozen similar cases where he felt perfectly sure that he had left sarcomatous tissue behind at operations done eight, nine, and ten years ago, and yet a cure followed.

In regard to the value of amputation in these cases, the speaker said he recently saw a man whose leg he had amputated just below the hip three years and four months ago for a sarcoma of the tibia and lower part of the femur. Up to the present time there are no signs of a recurrence. In another case of sarcoma of the tibia he amputated through the middle of the femur four or five years ago, and he had reason to believe that the patient is perfectly well to-day. It has been the speaker's experience that amputation done a few inches above the affected bone has given quite as satisfactory results as enucleation of the bone higher up, and that in those cases where a recurrence has taken place, it was apt to be far distant from the point of operation.

Dr. John D. Rushmore said that three or four years ago he saw a boy with a fracture of the femur. A month after bony union had taken place, the boy began to complain of pain at the site of the fracture, and upon examination a swelling was made out there which rapidly increased in size. The glands in both groins also became enlarged; some of these were removed, and the pathologist reported that they were composed of small-celled sarcomatous tissue. The case had apparently progressed too far for operation, and a very unfavorable prognosis was given. That boy is still alive, and the enlargement of the bone has not increased. Dr. Rushmore said he could recall half a dozen other cases where he had been led astray by the pathologist's report.

The patient referred to by Dr. Coley was still alive five and one-half years after operation. In that instance the diagnosis of sarcoma was undoubtedly correct.

TRANSACTIONS OF THE CHICAGO SURGICAL SOCIETY.

Stated Meeting, May 5, 1902.

ARTHUR DEAN BEVAN, M.D., in the Chair.

CARCINOMA OF THE LARYNX.

DR. BEVAN presented three cases of carcinoma of the larynx. The first would serve as an example of the method of handling these cases which had generally been adopted in the past. The carcinoma had existed for a number of months, and it was either not recognized sufficiently early, or it was not thought warrantable even in the early development of the case to do a radical operation. The carcinoma had gradually extended from the larynx to the œsophagus; a tracheotomy was necessary in order to relieve the great dyspnœa. This was done by Dr. Otto T. Freer, who then had charge of the case. The patient had worn a tracheotomy tube for a number of months. Gradually in its development the carcinoma had encroached upon the œsophagus, and on that account the case had been referred to the surgical service to decide as to the advisability of doing a gastrostomy. The patient at present could not swallow, so that it was necessary to resort to rectal feeding. Both fluids and nourishment had been given by the rectum for a number of weeks, and there was left nothing practically except the palliative measure of gastrostomy, which in this particular case was not indicated, as rectal feeding was well borne by the patient, making him fairly comfortable.

The second case he presented was a patient upon whom the late Professor Christian Fenger made a complete laryngectomy, it being one of the last operations which Fenger performed before his death. The patient made a very good recovery from the operation. In this case a preliminary tracheotomy was done, and

some time after the preliminary tracheotomy the complete removal of the larynx was undertaken. The patient, because, on account of sloughing, the pharynx was not closed from the external wound, although the effort was made to obtain complete closure by sutures, was now in a condition in which many of the earlier cases are found, wearing a tracheotomy tube, with an opening at the floor of the mouth, and in such a condition that it was necessary for him to use a stomach-tube in order to obtain liquid nourishment. The man had been very much improved by the operation, and was now in a condition to wear an artificial larynx of the original type, where the air was forced from the trachea up into the mouth cavity through the opening in the floor of the mouth.

The third case was one upon which Dr. Bevan had operated about four weeks ago. It represented, he thought, the best method of handling these cases. The patient was brought to him by Dr. Dickerman with early recognized carcinoma of the larynx, more extensive after he had removed the gross specimen than would appear from examination by the clinician. He thought the case was very appropriate for the removal of the entire larynx. This was done by the operation suggested by Keene in 1900, and which had been carried out practically with some modifications by Kocher in a considerable number of cases.

The operation was done in the following way: No preliminary tracheotomy; an incision was made from the hyoid to the sternum; the larynx and the trachea were very freely and cleanly dissected in front and laterally; the patient was then put in the Trendelenburg position; the trachea was divided just below the cricoid and brought into the lower angle of the wound, and stitched into position by four large silk sutures; the mucosa of the trachea was united accurately to the integument by fine horsehair sutures. The entire larynx was then removed; the opening in the pharynx and œsophagus entirely closed by deep buried sutures. The patient now had a complete closure, separating the trachea from the œsophagus and the pharynx. Fortunately, the wound healed by first intention throughout. Patient could swallow and eat. He wore no tracheotomy tube.

He mentioned the new method of employing an artificial larynx, as suggested by Gluck, by which a short tracheotomy tube is introduced temporarily into the opening in the trachea,

the air carried by a rubber tube, some rubber bands put in vibration along the course of the rubber tube, and a small catheter introduced into the nose, so that the sound is carried into the mouth cavity, enabling the patient to talk or sing without much difficulty. He had not applied an artificial larynx in this case. This case had been handled throughout without any tracheotomy tube. He experimented with a tracheotomy tube at the time of the operation, and found it was a great source of irritation. Without the tube the patient could breathe normally; with it there was great effort at expulsion, increased secretion of mucus, and conditions which impressed the surgeon with the fact that the mere use of the tube was probably one of the causes of the pneumonias which proved so fatal in these cases.

Until recently the profession generally, both throat specialists and general surgeons, felt that cases of carcinoma of the larynx should be let alone. He had been converted from that belief to this position, that cases of carcinoma of the larynx should be operated upon in practically all instances seen early, and the earlier the better. When cases were absolutely inoperable, as the first case reported, they had passed beyond the possibility of operative relief; but cases seen early by the general practitioner or the throat specialist should be operated on always, because, if left alone, almost invariably tracheotomy was necessary later, and patients presented the distressing picture shown in the first case.

Recently von Bruns had collected 271 cases of operations for carcinoma of the larynx done from 1890 to 1898. These operations comprised thyrotomy, subhyoid pharyngotomy, partial and complete extirpations of the larynx, etc. Of the 271 cases operated upon by various methods of procedure, thirty-four were permanently cured in the sense that they lived more than three years without recurrence; forty-two, or 15.5 per cent., lived without recurrence from one to three years, making 27.5 to 28 per cent. of the cases which lived from one to three years without recurrence. Sixty-five, or 25 per cent., of the cases had recurrence within a year; seventy-four, or 27 per cent., of the cases had rapid recurrence, and about 19 per cent. died as the immediate effect of the operation. The recent statistics of Kocher were better. Kocher had done twenty-four complete laryngectomies, with but two deaths; five of the patients were free from

recurrence, one of them four and a half years after the operation. Von Bruns had reported one interesting case which was free from recurrence eight years after operation.

The speaker was inclined to believe that a careful investigation of this subject would lead surgeons to these conclusions: *First,* that carcinoma of the larynx, early recognized, could be removed by complete laryngectomy, or possibly by a less major operation, as a partial laryngectomy, or thyrotomy, with a mortality not exceeding 10 per cent.; *second,* that of the cases which recovered from the operation, about half of them would live from one year to eight years without recurrence; *third,* that if these cases were analyzed alongside of those which had not been interfered with, as control cases, one would be led to the conclusion that early operative interference was not only warranted, but dictated, by the future history of the cases.

Dr. Edward T. Dickerman said he could not agree with the radical statement of Dr. Bevan that all cases of carcinoma of the larynx should be operated upon. In a number of instances, where the growth was confined to the larynx, if let alone, the patients would live for a number of years with a good-sized carcinoma of this organ. In cases like the first one exhibited by Dr. Bevan, he thought an operation was hardly practicable, for the reason that there was almost sure to be a recurrence. One was hardly justified in placing a patient's life in such great danger when a simple tracheotomy would enable such a patient to live from two to three or possibly four years. Moreover, it had been shown that fully 10 per cent. of the patients died as the direct result of laryngectomy. He had in mind three cases that had come under his observation which he deemed unfavorable for operation. Tracheotomy was resorted to in these cases, and one of them lived one year, the other had lived two and a half years, and the third was now in his fourth year with carcinoma of the larynx. He did not think that in any of them total laryngectomy was indicated. Where the growth was confined to the larynx, then a laryngectomy might be done.

Dr. William E. Casselberry stated that his views upon carcinoma of the larynx, as regards the advisability of operation, had changed materially in the last few years. The former statistics of laryngectomy were very bad, and the immediate mortality from complete laryngectomy was somewhere between 40 and 50

per cent. previous to 1890. Of the patients who survived the operation, the recurrences were numerous, and the number that were ultimately saved was reduced to about 5 per cent., only a small percentage recovering, after making allowance for errors in diagnosis. As to the nature of operations, a division of the thyroid cartilage and a shelling-out down to the cartilage of all carcinomatous tissue, which was an operation in vogue in London at the present time, employed by Butlin and Lennox Brown in early cases of carcinoma of the larynx, gave statistics which compare favorably with those given by Dr. Bevan as to total laryngectomy.

The reason for the preference of thyrotomy in cases seen early was the avoidance of mutilation of the patient. Following this operation swallowing was not interfered with, and the patient was able to talk, which was a great desideratum. It was not intended to urge this operation in advanced cases, but where the cases could be seen early and operated promptly by thyrotomy, they were saved the necessity of laryngectomy. Given a case in which laryngectomy became necessary, he thought there was no question but that the method depicted in the third case by Dr. Bevan was the best. The only objection urged against the operation done heretofore was that it was impossible to adjust an artificial larynx. However, by the newer method mentioned by Dr. Bevan this objection could be obviated.

Dr. Jacob Frank said that some three years ago he presented a patient before the Society upon whom he had performed a laryngohyoidectomy, that is, the entire removal of the larynx, hyoid bone, and epiglottis. This patient could swallow and could speak so as to be heard all over a good-sized room.

Dr. Gottstein (first assistant to Professor Mikulicz, of Breslau, Germany, by invitation) said that this method was done in 1881 by Glück, who had performed thirty such operations. In the Mikulicz clinic the same method was employed. This method was not often followed by pneumonia. He had modified Glück's artificial larynx, in that he introduced the air by a tube in the mouth. His patient could not only speak in a loud voice, but could sing. He cited a case such as the Solis-Cohen case, where the patient learned how to speak by sucking air into the pharynx and upper œsophagus, and modulating it by the tongue and a remnant of the epiglottis. After a careful study of the above

case, and some observations made on two other cases, Dr. Gottstein was of the opinion that by careful training and constant practice by the patient it was not only possible, but probable, that a large percentage of these cases could be taught to talk.

THE HARTLEY-KRAUSE FLAP IN HÆMORRHAGE FROM THE MIDDLE MENINGEAL ARTERY, WITH REPORT OF TWO CASES.

Dr. Samuel C. Plummer, Jr., read a paper with the above title, for which see page 591.

PERFORATION OF THE SMALL INTESTINE IN TYPHOID FEVER.

Dr. G. E. Armstrong, of Montreal, read a paper with the above title, for which see Annals of Surgery for November.

Dr. Frank Billings said that perforation of the bowel occurred in typhoid fever in practically 3 per cent. of the cases. The severity of typhoid fever in its clinical course bore no relation really to perforation. Those who had the disease in mild form were just as likely to have perforation as those who were severely sick. The number of ulcers in the intestine bore no relation to the height of the fever or to the severity of the general course of the disease. In other words, an individual suffering from typhoid fever might become as deeply toxic from a single ulcer of the intestine as from numerous ulcers.

Pain was one of the mainsprings of diagnosis. Pain in typhoid fever might be due to local inflammation of the peritoneum and adhesions might play a part. He recalled a patient whom he saw ten years ago at St. Luke's Hospital, who had severe pain, with collapse, cold extremities, etc., and what appeared to be a perforation. A laparotomy did not show that the patient had had peritonitis, with adhesions, but a local constriction of the gut which produced tympanites, from which the patient suffered, and the great toxæmia in the course of the fever led to the collapse. The patient recovered from the immediate effects of the operation, and afterwards died as the result of prolonged toxæmia from the typhoid fever. Pain might be due to inflammation or infection of the mesenteric glands. These might rupture. In that event, it was practically the same as a

rupture of the intestine requiring operation. He acquiesced in all the essayist had said concerning the important symptoms.

As to leucocytosis, he thought physicians did not appreciate its proper value, if it were used as it should be. If the leucocyte count was properly carried out, it would prove of great value. This was not done in most hospitals because of lack of help. It was impossible to get both house physicians and nurses to make the necessary observations of the blood. He thought more importance should be attached to leucocytosis in typhoid fever cases than there had been, and if blood counts were taken sufficiently often they might prove of great value. He said his function as an internist was to so observe the patient that he might note the conditions accurately enough to either say that perforation was imminent or had occurred, and then call a surgeon to his aid in six hours or twelve hours, as the case might be. The earlier an operation was performed in cases of perforation of the gastro-intestinal tract, the greater the chance for recovery of the patient.

Dr. N. B. Carson, of St. Louis, Mo., called attention to those cases which presented the symptoms of perforation, but which recovered, the perforation taking place between the layers of the mesentery. Recently, a professional friend of his had a relative who presented all the symptoms of perforation of the intestine, but recovered without operation. The patient presented symptoms of sepsis for some time, and the question arose whether this might not have been due to a perforation between the mesenteric folds with a small abscess which developed and had discharged through this opening. In proof of this condition were, he thought, many of these local abscesses, such as were cited by the essayist, in the lumbar region. Furthermore, there were the so-called psoas abscesses, and it had often struck him that perforation had taken place between the folds of the mesentery and had burrowed back, forming the local abscesses.

Dr. E. Wyllys Andrews reported a successful case of operation for typhoid fever perforation, operated at five o'clock in the morning, after having been diagnosed at midnight. The patient made not only a rapid recovery from collapse, but from the previous high temperature that ran a course of some three months, with relapsing typhoid fever. This led him to the conclusion that possibly a minute leak was present, which had caused sepsis, but, at the same time, in thinking the matter over afterwards, he was

unable to recall that the peritoneum showed any signs whatever of having been chronically irritated.

One point mentioned by the essayist needed re-emphasizing, namely, the advice given in treatises and crystallized into a maxim, that in perforation of the intestines, threatening peritonitis, as well as in gunshot perforations, operation should be postponed for the period of reaction. This was a maxim which was as old as surgery, and to his mind, when applied to septic conditions in the abdomen, was absolutely negatived by all the experience he had ever had. The advice of the essayist to make the earliest possible operation and forestall the occurrence of shock was the only correct one to take.

DR. ALEXANDER HUGH FERGUSON mentioned one case upon which he operated for a supposed appendicitis. The patient had typhoid fever, and while convalescing had severe pain in the region of the vermiform appendix, where a tumor developed. Upon cutting down he found an abscess which had communicated with the bowel. There was gas in the abscess. The appendix was situated completely behind the cæcum extraperitoneally.

DR. L. L. MCARTHUR reported three unfavorable results in fairly early operations for intestinal perforation. He had had no successful cases, although he had operated four times,—in one case referred to by Dr. Billings, and in three other cases in his hospital services at Michael Reese and St. Luke's. In going through the medical ward of Michael Reese Hospital to get an internist to see a surgical case with him upstairs, he found a man lying in bed, pale, and in a state of collapse, sweating, etc. He spoke to the physician, and asked him why he was allowing the patient to die, and he replied that the man had just been discharged and was going home. They walked back to the bed together, and found the patient in collapse, with evidences of intestinal perforation. The man was immediately put on a stretcher, taken to the operating-room, his abdomen opened, and a perforation of the ileum found, with the escape of intestinal contents into the abdominal cavity. He thought within three-quarters of an hour from the time perforation had occurred the abdomen was opened, the perforation sutured, and the abdomen drained. The perforation was about the size of a small lead-pencil. The abdomen was mopped out, not flushed, with salt solution and drained down to the line of sutures.

He was heartily in favor of operation, notwithstanding the unfavorable results that had attended the cases he had operated upon, and still believed that the only proper course to pursue was to resort to surgical intervention.

Dr. M. L. Harris said that in some cases no increase in the number of leucocytes is found. In the same kind of infection, in one patient there would be an increase in the number of leucocytes, while in another case there would be no increase, so that physicians had learned not to place too much reliance on the mere enumeration of the leucocytes in diagnosis. He referred to the changes in variety and quality of the granules. In cases of infection by the typhoid bacillus there was leukopenia, as a rule. This was a characteristic and important diagnostic feature in typhoid infection.

He narrated a case which he saw recently in consultation which presented evidences of acute cholecystitis. There was elevation of temperature, distinct localized tenderness, enlargement of the gall-bladder, with thickening, which could be readily outlined, and the question arose as to an operation for the relief of the acute cholecystitis. On removing the patient to a hospital and examining the blood, he found leukopenia. The absence of the characteristic granules and other evidence led him to think of typhoid infection. A Widal reaction was made, which was distinctly positive, and the case was treated as one of typhoid fever.

He was inclined to lay more stress on a change in the variety or quality of granules than on the slight difference in the leucocytic count.

In peritoneal infections, leucocytosis was not so marked as it was in infections of the connective tissue. This he had noticed recently in two cases, in which no blood examination had been made. One was a case of infection of the connective tissue, in which there was decided leucocytosis; the other was a case of peritoneal infection which he thought would result fatally. The temperature in this case had arisen to 107.2° F.; there was no leucocytosis, but there were distinct iodophilic granules. A careful study of the blood was of the utmost importance in differentiating between the different kinds of infections.

Dr. Armstrong, in closing the discussion, said that the toilet which was applicable in cases of typhoid perforation could like-

wise be employed in any form of infective peritonitis. His first idea was to bring everything, if possible, into view, as he did very little in the dark, and by padding and careful manipulation, after placing the patient in the proper position, he endeavored to get the field of the infected area exposed to view, and then used swabs. When the infection was wide-spread, he was satisfied that one could do much better with swabbing than with solutions and douching. In flushing the abdominal cavity he preferred a soft tube, so as to flush the bottom of the cavity. This was the toilet he adopted in all infected cases. In typhoid cases he filled the abdomen full of normal salt solution at a temperature of 110° to 112° F., using a rubber tube.

As to sutures and suture material, he used two rows, and sometimes, if the patient was in good condition, a third row. For closing the opening he used one or two sutures of fine catgut for the first row, and also catgut for the second row, and then he preferred fine silk over that. He was aware that many surgeons only used two rows of sutures, but he felt safer with a third row.

He agreed with Dr. Billings that a blood count should be taken quite frequently if there were suspicions of perforation of the intestine. The point he desired to bring out in his paper was that because one found leucocytosis, eliminating other things, it was not a sufficient guarantee for opening the abdomen, and if the symptoms were fairly well marked, he would not hesitate to operate, even if there was no increase in the number of white cells.

EDITORIAL ARTICLE.

THE HEALING OF NERVES.[1]

THE very uncommonplace way in which this work by Ballance and Stewart has been published will be a surprise to many in these days of hurried and ephemeral book-making. To some its appearance—the ample page, the excellent type and paper, the elaborate care taken in every line and in each of the sixteen elaborate plates by authors and publishers alike—will recall the "Ligation of the Great Arteries in Continuity," published in 1901, Mr. Ballance then having Mr. Edwards as his fellow-worker. Those who are familiar with the earlier will find in the later work the same endeavor to make each chapter complete and each statement accurate. In a note, Mr. Ballance states that the number of preparations, each prepared by the best modern microscopical methods, on which this paper is based, are due to the knowledge and energy of Dr. Purves Stewart. In the preface we learn that the original drawings for the illustrations were made by Mr. M. H. Lapidge, the same artist who made the plates and drawings for the "Ligation of the Great Arteries in Continuity."

We have spoken above of this work as being eminently uncommonplace. In these days of competition and hurry, it is as refreshing as it is striking to find on the second ample page four quotations from the Bacchylides, Manilius, the "Merchant of Venice," and R. L. Stevenson's "El Dorado."

The time was ripe for a fresh work on the vexed question of the Healing of Nerves. In 1872, Dr. Weir Mitchell published

[1] THE HEALING OF NERVES. By C. A. BALLANCE, M.S., F.R.C.S., Assistant Surgeon, St. Thomas's Hospital, and Lecturer on Surgery in the Medical School; and PURVES STEWART, M.D., M.R.C.P., Assistant Physician, Westminster Hospital. Quarto. Macmillan & Co., 1901.

his "Injuries of Nerves," rich in realistic descriptions. In 1889, Mr. Bowlby placed before the profession his "Injuries and Diseases of Nerves and their Surgical Treatment." Both these books were written from a clinical aspect, and will still repay careful study, Mr. Bowlby's having the especial merit that, like the late Professor Ollier and his cases of excision, large numbers of patients were kept under observation for many years. In the work before us the research has been mainly on histological grounds, and the observations having been chiefly made upon animals, the number of clinical observations here recorded is not large. But while this restriction is somewhat disappointing, it must be remembered that in this work we have for the first time, as far as the English tongue is concerned, experimental operations carried on, on the one hand, by one thoroughly skilled in operative and aseptic surgery, and on the other, the histological results of these experiments examined and recorded by an expert in modern microscopical methods.

It will facilitate our review of this book and render clear the objects of the authors, if we turn first to Chapter vi, p. 92, where it is stated that workers on the manner in which regeneration takes place in a divided nerve may be classified into two schools; these may be termed the "central" and the "peripheral" respectively. Of these the "central" school, to which the great majority of writers belongs, maintains that the new axis-cylinders are direct outgrowths from those in the central segment, the young axis-cylinders sprouting downward and worming their way into the empty neurilemma sheaths of the distal segment to replace the old axis-cylinders previously degenerated and absorbed. According to this school, the peripheral segment plays an entirely passive rôle, and no regeneration can take place in it unless it has been united to the proximal one.

The "peripheral" theory, on the other hand, is that the new fibres in the distal segment—axis-cylinders, medullary sheaths, and neurilemmata alike—are formed from pre-existing cells in

the distal segment itself. The young axis-cylinders and medullary sheaths are laid down in the first instance in the distal segment, and they become attached later to those of the central segment, thus restoring the conductivity of the nerve-trunk. To this latter view Mr. Ballance and Dr. Purves Stewart unhesitatingly declare their adherence. We propose now to see, in some detail, how the writers arrived at the above most important conclusion, and how far it is justified.

To begin with, the *chief objects of their research* were:

(1) The process of degeneration in a peripheral nerve after injury; (*a*) without and (*b*) with immediate suturing of the proximal to the distal segment.

(2) The process of regeneration in a nerve-trunk, which has been divided and subsequently reunited by suture.

(3) The process of regeneration, if any, in the distal segment of a nerve-trunk which has been divided, but in which the proximal and distal segments have not been brought into apposition.

(4) The changes which occur in nerve-grafts.

Methods Employed.—The specimens obtained from monkeys, dogs, and cats, and, in some cases, during operations on the animal subject, after being fixed in Müller's fluid or solution of formalin, were stained by one of the following four methods:

(1) Weigert's method for the selective staining of the medullary sheaths.

(2) Cox's modification of the Golgi method for the impregnation of the axis-cylinders.

(3) Stroebe's method for the staining of the axis-cylinders.

(4) Van Gieson's method for the staining of the cellular and protoplasmic structures, *e.g.*, leucocytes, connective-tissue corpuscles, and neurilemma cells.

We will take first the authors' conclusions as to the way in which regeneration of the medullary sheaths takes place when staining by the Weigert method has been employed.

Regeneration in Nerves that have been United.—The earliest date at which any new sheaths are discoverable is at the end of the second week. These are developed in the *proximal* segment close above the plane of division. The new sheaths lie not in the axis of the old ones, but eccentrically and in close apposition to the cells of the neurilemma. These cells do not share in the degenerative process. The new sheaths are not outgrowths, branches, or continuations from the old sheaths of the normal nerve-fibre above. They are formed entirely apart from them. Tracing the process from the plane of division upward, small isolated groups of new sheaths are visible, whose general direction is sinuously longitudinal. It is particularly to be observed that each group is an island which has at first no physical continuity with the peninsula of the normal medullary sheath above, to which, however, it is subsequently guided during its growth within the neurilemma tube. At a higher level, adjacent islands of the same longitudinal series have become a continuous tubular plexus within the neurilemma, and, higher still, the plexus is continuous with the end of the normal sheath.

On the *distal* side of the plane of reunion no new myelin sheaths are visible at the end of three weeks, but at the end of four weeks they are to be seen in great abundance in the entire extent of the nerve. It is important to observe that whilst there are, at the end of four weeks, numerous new myelin sheaths both in the proximal and distal segment, they are relatively scanty in *the intervening scar-tissue*. These new sheaths, seen in the *intervening scar-tissue* at the end of the fourth week, are more numerous than in the adjacent part of the central segment and much less abundant than in the distal segment. It cannot, therefore, be claimed that regeneration is a process of sprouting from the proximal segment, otherwise the new medullary sheaths would progressively diminish in number instead of increasing from above downward.

Transplantation Experiments.—Of these only four were performed. Degeneration occurs in the graft exactly as in the distal segment of the divided nerve. The graft iself is a dead tissue, and is gradually absorbed and replaced, like blood-clot, by a living tissue. At the end of four weeks the graft is degenerated, and there are no new myelin sheaths in its substance, such as have been formed in the distal segment of the nerve-trunk below. But by the end of five weeks, in the monkey numerous young myelin sheaths are present in the graft, chiefly in the neighborhood of the ingrowing blood-vessels. The neuroblasts from which the embryonic sheaths are derived do not originally belong to the graft itself, but are to be numbered among the cells which invade and replace the graft from the distal as well as the proximal segment. The invading neuroblasts travel into the graft alongside the blood-vessels, for the embryonic sheaths are found in greatest abundance in their immediate vicinity; this method of entrance facilitating nutrition of the actively growing sheaths. The graft is, therefore, a scaffolding invaded equally throughout its length by neurilemma cells[1] from without, both from the proximal and distal segments. These enter along the blood-vessels, their path being one of minimum resistance and maximum nutrition.

We take next the results of the authors as to the regeneration of *axis-cylinders,* the nerves being stained by the Golgi method, a method which was found, when successful, to give striking results, but one in which success was difficult of attainment. The specimens obtained presented a striking confirmation of the results given by the Weigert method. In the normal nerve prepared by the Golgi method, a few "spider-cells" can be seen, scantily distributed. In a divided nerve the earliest stage of regeneration occurs in the proximal segment at the end

[1] The derivation of the neuroblasts or young axis-cylinders from the neurilemma cells in the distal as well as in the proximal segment is dealt with again, at some length, below.—REV.

of the second week, and consists in an increase in the number of the "spider-cells." In the intermediate scar-tissue at this date no axis-cylinders or "spider-cells" can be distinguished, but at the end of the third week regenerative changes are well marked both in the scar-tissue and in the distal segment. In the proximal segment the processes of the "spider-cells" run longitudinally; in the intermediate scar-tissue they form a delicate interlacing network, and in the distal segment they are both larger and more numerous than in the proximal segment, and are arranged with longitudinal parallel processes growing out from opposite ends of each cell. They approach the processes of the next cell of the same longitudinal series, but do not anastomose. At the end of the fourth week the processes of the "spider-cells" in the distal segment are much longer than at three weeks, but do not yet anastomose, though they often overlap. The writers consider they have clearly established that the regeneration of the axis-cylinders does not take place by a process of outgrowth from the proximal segment, but is commenced and completed by the activity of cells already existing in the trunk of the nerve. We shall see shortly that these "spider-cells" are again the neuroblasts or young axis-cylinders, and that they are derived from neurilemma cells. On the results obtained by Mr. Ballance and Dr. Purves Stewart on the regeneration of axis-cylinders in nerves stained by the method of Stroebe for differentiation of the above cylinders, we do not propose to dwell, as the authors found this method to be very uncertain in its results.

Last comes the result of the authors' investigations into the part played in the regeneration of nerves by the different cellular tissue elements, viz., leucocytes, connective-tissue cells, and neurilemma cells. Here Van Gieson's picrofuchsin and hæmatoxylin method was employed from its especial value in the study of the above cellular elements.

A. *Leucocytes.*

Specimens obtained six hours after the injury exhibit extravasation of blood and diapedesis of leucocytes, such as would occur in any injured tissue. At the end of eighteen hours, the leucocytic invasion reaches its maximum. It is particularly to be noted that the whole extent of the distal segment is invaded, whilst the proximal segment is only so affected in the vicinity of the wound. It is, therefore, evident that as a consequence of loss of function some chemical alteration has already occurred in the distal segment, sufficient to induce the leucocytes to wander into the dying tissue, and this in spite of the fact that no structural changes are detected either in the axis-cylinders or the medullary sheaths until the fourth day. The function of the leucocytes is apparently a transient one, for at the end of three days many of them have already been replaced by migratory connective-tissue cells.

B. *Connective-Tissue Cells.*

The proliferation of these cells, from whatever source derived (whether from the connective-tissue elements of the nerve-trunk, or from the surrounding structures), begins at a distinctly later period than the leucocytic invasion. A possible explanation may be offered in the fact that leucocytes, being already present in large numbers in the blood, form a standing army ready to move instantly in the direction of an irritant; whereas the connective-tissue cells must abandon their quiescent habit and proceed to multiply or mobilize before they can advance into a tissue which it is their function to absorb and replace.

C. *Neurilemma Cells.*

The rod-shaped nucleus of this cell stains with the same intensity as the connective-tissue nucleus; but when both varieties of cells are in great abundance, there is no difficulty in distinguishing the long rod-shaped nucleus of the one from the short oval

nucleus of the other. The earliest indication of proliferation occurs in the distal segment of a divided nerve at the end of two days. By this time, probably in response to some early chemical change in certain of the medullary sheaths with which they are in contact, the neurilemma cells abandon their resting condition and commence actively to multiply in discrete patches. Each parent-cell divides, so that the resulting daughter-cells somewhat overlap each other, and by successive division they form closely set longitudinal columns or chains. Putting aside the leucocytic invasion already discussed, the earliest cells observed to multiply in the degenerating segment of a divided nerve are not the cells of the ordinary connective tissue, but those of the neurilemma.

The proliferation of the neurilemma cells, at first patchy, soon becomes general. It has commenced at the lower end of the proximal segment by the end of the third day, but it does not extend in a central direction beyond the vicinity of the injury; whereas in the distal segment it takes place simultaneously, at this date, throughout the whole length of the nerve, whether it has been sutured or not. This proliferation of the neurilemma cells has for its immediate object the removal of the functionless fatty débris of medullary sheaths and axis-cylinders, in which work the neurilemma cells co-operate with the connective-tissue cells which come in, as already described, from the perineurium. The work of fat-absorption, however, though initiated by the neurilemma cells, is performed mainly by the connective-tissue cells, and even while this process is as yet unfinished, the neurilemma cells give up the struggle for the remaining spoil of food, and resign themselves to the formation of separate and compact columns, the individual elongated cells of which are arranged longitudinally. The elongated cells which form these columns proceed later to send out from their opposite poles fine protoplasmic processes which gradually increase in length. Thus, within each old neurilemma sheath numerous new fibres are laid down in short lengths; these afterwards blend and become con-

tinuous so as to form the regenerated axis-cylinder, which shows evidence of its youth by its greater sinuosity and by the existence of beaded thickenings at intervals. *The more the specimens are studied, the more is the conclusion forced upon the mind of the observer that for the regeneration of a peripheral nerve-fibre (not only the axis-cylinder, but also the medullary and neurilemma sheaths) the activity of one variety of cell, and one variety only, is responsible. That cell is the neurilemma cell.*[1] In support of this most important statement, we may refer to the account of the regeneration process as described above from specimens impregnated by the authors by the Golgi method. It will be remembered that they found that at the end of three weeks numerous longitudinal "spider-cells" could be seen in the distal segment, shooting out young, beaded axis-cylinders from their opposite poles. These new axis-cylinders, also met with at this date in the scar-tissue lying between the two segments, rapidly increase in length, and, at the end of four weeks, have grown so as to overlap and anastomose. *The writers have been able to convince themselves that the "spider-cells" or neuroblasts demonstrated by the Golgi method are identical with the proliferated neurilemma cells.*[1]

The writers point out that on this subject the process of nerve-regeneration in the growing tail of the lizard bears a very striking resemblance to the results obtained in their series of observation. Galeotti and Levi (*Ziegler's Beiträge zur Path. Anat.*, 1895, xvii, pp. 369-412) studied the process of nerve-regeneration in lizards whose tails had been cut off, and in which (in sunny weather) new tails grew in about fourteen days. In the central stump the nerve-fibres degenerated upward for only a short distance. Regeneration then commenced, the first stage in the process consisting in a proliferation of the neurilemma nuclei, which became elongated and arranged in definite rows. The ends of adjacent cells later overlapped and fused together.

[1] The italics are our own.—REV.

Clinical Considerations.—The writers point out that the objects of their research being mainly histological, and their observations having been chiefly made upon animals, the number of clinical observations which they have recorded is not large.

As regards *primary suture* in dogs, they observed that when the nerve was reunited by immediate suture, motor power began to reappear in the paralyzed muscles after an interval usually of about four weeks. This date, it will be observed, corresponds to that determined by our authors as necessary for the process of regeneration to occur. The return of sensation was not recorded by the authors in their animals, owing to the difficulty of assuring themselves of the trustworthiness of such observations. With regard to man, it has been already recognized that two months at least must be allowed to elapse after *primary suture* before the return of function can be expected.

With regard to the employment of *nerve grafts,* it is well known that the results are highly contradictory. The writers' cases hitherto recorded, two in number, confirm the above. In one case, in which two inches of sheep's sciatic nerve were transplanted into a gap in the ulnar nerve in the human subject, sensation began to return twenty days after the operation, and was complete six months later. In another case of sciatic paralysis, where six inches of bullock's sciatic had been transplanted, no return of sensation had occurred up to five months after the operation.

A point of much interest, long observed after *secondary nerve suture,* is elucidated by the authors. We refer to the early return of sensation noted in some cases a few hours after the operation. This has been explained in different ways. A certain number of cases may be discounted as errors of observation, others may be explained by an unusual anastomosis or distribution of nerves. In the proportion of cases which remain unaccounted for, we must admit that restoration of conductive continuity (usually only a temporary restoration, though it may recur

later on) is to be explained by a process of what has been called "immediate repair" of the divided axis-cylinders on each side of the division. Mr. Ballance and Dr. Purves Stewart consider that "these cases of early return of sensation are readily explained when we remember the mode of regeneration in the distal segment, not by a process of down growth from the proximal segment, but as a pre-existent accomplished fact—immature, it is true—in the distal segment before reunion had been brought about. Secondary suture in those cases permits of restoration of conductivity in the new fibres already existent in the distal segment by joining thereto those of the central segment."

With all deference to these authorities, we cannot admit that this most interesting question of very early return of sensation after secondary nerve suture has been "explained" by their results. They throw a very interesting light upon it, but no more. This return of sensation, as is well known, takes place in some cases in some hours, only, as a rule, to disappear.

Now our authors have shown that the process of degeneration which must precede regeneration is taking place over a very much longer period. First, an invasion of leucocytes affecting the whole distal segment, but the proximal segment only near the wound. This invasion reaches its maximum about the eighteenth hour. After three days connective-tissue cells, wandering in, begin to take the place of the leucocytes; these proliferate, and on the fourth day begin to absorb the myelin. And so on. It is clear that the early, sometimes very early, return of sensation after secondary nerve suture remains, as yet, unexplained.

We trust that the above imperfect review of this most interesting and instructive work will lead other surgeons to study it with the care it deserves, and to weigh the fact that Mr. Ballance and Dr. Purves Stewart have given a most decided impetus to the views of the "peripheral" school of nerve regeneration. In other words, they have proved conclusively that the distal segment of a divided nerve is not, as hitherto believed, the inert, de-

generated, passive structure which depends for its repair solely on the shooting down into it of axis-cylinders from the proximal or central segment. They have shown as conclusively that it contains within itself, in its power of reproducing neurilemma cells, the ability to form neuroblasts and fresh axis-cylinders. The importance of this observation to surgeons cannot be too highly estimated. And be it remembered that this book, which in later years will probably be recognized as "epoch-making" or "path-making," is not by unknown men. It is the outcome of labors—and when the number of experimental operations, the hosts of sections to be cut and stained, from which those illustrating the sixteen exquisite plates have been selected, when these are weighed the word labor is hardly adequate—of a physician highly trained in histology and neurology alike, and of a surgeon whose name already stands very high on account of his operative skill, his wide view of modern surgery, and the scientific bent of his mind.

By the labors of such men, a firm foundation, trustworthy because consisting of the facts of the most recent histology, has been laid; it remains for surgeons working from the clinical side and by operation on man to raise a superstructure which shall be worthy of the foundation which we have in this work of Mr. Ballance and Dr. Purves Stewart.

W. H. A. JACOBSON.

INDEX TO SURGICAL PROGRESS.

GENERAL SURGERY.

I. Gas Phlegmons. By Dr. A. Stolz (Strassburg). The object of this article is to subject to a critical review the organisms which are involved in the production of gas phlegmons. The conclusions are that the Welch-Frankel bacillus (an anaërobic *non-motile* butyric acid forming bacillus) is the main factor in producing a gas infection. Closely allied to it, though rarely encountered, is an anaërobic *motile* butyric acid bacillus described by Wicklein in three instances and encountered by the author once. It is doubtful whether in gas phlegmons we have any longer to reckon with the formerly recognized bacillus of malignant œdema.

Among the aërobic bacilli a number of undoubted Proteus vulgaris, hauseri, coli and paracoli infections were encountered, and on these occasions it was possible to demonstrate that these latter bacilli do not require the co-existence of diabetes. Finally, exceptional cases are reported that are traceable to other organisms, which will have to be reckoned with hereafter, dependent on accurate bacteriological data.—*Beiträge zur klinischen Chirurgie*, Band xxxiii, Heft 1.

THORAX.

I. Pulmonary Embolism after Injuries and Operative Interference. By Dr. G. Lotheisen (Innsbruck). Lotheisen was able to collect sixty-one reported cases of pulmonary embolism with fifty-two deaths, representing a mortality of 83 per cent.

Following fractures, thirty-six instances are specified, occurring with equal frequency in both sexes between the ages of twenty-five and sixty-six, fractures of the leg being most repre-

sented. Six instances are reported after contusions of the abdomen and extremities, the male sex being favored; and four times subsequent to tendon and muscle ruptures.

Occurring after operative interference, sixteen cases are cited, five females, fifteen men, between the ages of seventeen and sixty-seven. Embolism occurred as early as twenty-four hours and as late as the fourth week. Embolism has an affinity for advanced years, no instances of its occurrence during infancy being reported. Women are particularly prone, as testified by the reports of gynæcologists, but in this summary males predominate. As a post-mortem finding, pulmonary embolism is more frequently encountered than in clinical reports, and, notwithstanding its rarity, itself is deserving of attention just because of its extremely sudden onset.

A particular disposition is favorable to embolism, thus anæmia incident to great loss of blood after uterine hæmorrhages, or after infectious diseases of long standing or cachexia, all are predisposing factors. The slowing of the blood current as the result of cardiac degeneration in alcoholics and pregnant women is likewise contributory to thrombosis. The thrombus which forms while the patient is recumbent is displaced with any strenuous movement upon arising. The diminution of intra-abdominal tension upon removal of fluids permits of a greater flow, whereby the thrombus can be displaced.

In view of the sudden onset of thrombosis, a sign foreboding its approach might be of value. Mahler describes a pulse-curve successively rising while the temperature remains low as being pathognomonic of impending embolism. Lotheisen does not give this his unqualified support, since an increase of pulse-rate often follows laparotomies from the manipulation of the bowel.

From a prophylactic stand-point it is commendable to avoid operations during or after pregnancy, and when these are executed, the pelvis should be elevated, massage avoided, and all severe and violent motions forbidden.

Embolism once at hand requires vigorous cardiac stimulation. —*Beiträge zur klinischen Chirurgie,* Band xxxii, Heft 3.

II. Decortication of the Lung in Chronic Empyema. By DR. KURPJWEIT (Königsberg). The author accords priority for this operation to George Ryerson Fowler. Preliminary to performing decortication, Delorme advises irrigation of the cavity with antiseptics for several days. Any pulmonary fistula must be sewn to obviate any subsequent pneumothorax.

The majority of operators do not make a trap-door incision as originally advocated by Delorme, but resect extensively, if necessary.

The results of the operation are set down by Delorme at 30 per cent. to 40 per cent. cures. Cestan gives 40 per cent. cures, 11 per cent. improved, 35 per cent. not improved, and 14 per cent. death. Fowler's report covered thirty cases,—seventeen cures, nine cases no cure, three deaths, and one doubtful. The interpretation of these combined statistics resolves itself into 35.7 per cent. cures, 19.7 per cent. improved, 33.9 per cent. no cure, 10 per cent. death. In six deaths pulmonary tuberculosis was encountered.

The gaping of the incision of the divided thickened pleura is not due to the expansion of the lung beneath, but is due to the release of the thoracic tension which permits of a greater amplitude in thoracic excursion, which in turn tears the pulmonary pleura, and though the lung appears to expand under forced expiratory efforts, such as cough, it does not follow that the lung beneath the diseased pleura possesses spontaneous qualities of expanding. Permanent expansion is only possible if adhesions between the thoracic wall and lung ensue.

Where a trap-door flap is made, pneumothorax follows, which hinders the expansion of the lung. The approximation of the soft parts to the lung is necessary to enable the lung to expand.

Delorme values the trap-door incision, since he claims it does not permanently deform the chest wall.

Compared with extensive resections, the statistics for the latter are 56.3 per cent. cured, improved 20 per cent., no cure in three, death in twenty. For decortication there are but 33.9 per cent. cured.

In three instances only was the trap-door incision performed, wherefore the author is disposed to attribute much of the success to extensive resections of the ribs with adaptation of the soft parts to the lung.—*Beiträge zur klinischen Chirurgie*, Band xxxiii, Heft 3.

GENITO-URINARY ORGANS.

I. Two Decades of Renal Surgery. By Dr. M. O. Wyss (Zurich). The author analyzes 113 operated cases from the stand-points of etiology, symptomatology, diagnosis, etc.

Etiology.—Traumatism may produce the most varied results. Its main interest centres in its producing but slight perirenal hæmorrhage, which in turn is capable of loosening the connective tissue and causing floating kidney, or, eventually, cicatrices that are likely to press upon the renal pedicle.

Hydronephrosis is always caused by a secondary pathologic factor that brings about obturation of the ureter, but this alone does not suffice. The author, supported by the observations of Israel and Landau, shows that still other factors must be active to effect hydronephrosis such as he sees in displacements of the kidney, which at the same moment affect the renal circulation in respect to its nutrition. Nephropexy permanently cured four cases of intermittent hydronephrosis.

In tuberculosis of the kidney heredity plays the usual rôle, particularly in the transmission from the father, whereas complication of other viscera was relatively seldom. The observation of fifteen operated cases showed no clinical evidence of systemic tuberculosis before operation, and because of the lasting cure

effected by operation, the author recommends operation for primary tuberculosis of the kidney. In spite of the repeated references to ascending tuberculosis of the opposite kidney, there are no such cases to report, even where bilateral catheterization of the ureters was practised. In thirty-four cases but twice was renal tuberculosis bilaterally encountered.

As to pyonephrosis, gonorrhœa is more frequently at fault than is granted, it being obscured by the mixed infection. Most of these cases are encountered between twenty and fifty years of age; females more frequently affected than males, and the right kidney more so than the left. These data, therefore, correspond to the dictum of the majority of observers.

Symptomatology.—Of the general symptoms nothing of note is emphasized. Hæmaturia may be peculiar to all affections, and it occurs in 80 per cent. of malignant growths. Rather than temporize in the face of a dubious hæmaturia and set it down as an essential hæmaturia, the author advocates an exploratory incision, providing hæmophilia can be excluded.

Attention is directed towards palpation, in so far as a manipulation of the kidneys may bring on a hæmorrhage or a flow of pus that will aid in the differentiation as to which of the kidneys is affected. Percussion is not dignified as a valuable aid.

As to ureteral catheterization, the opinion is expressed that the danger of infection is overestimated, and yet the findings must not be blindly accepted, owing to the possibility of anomalies. Cystoscopy alone suffices to show which kidney is affected, but catheterization determines the functions of the kidney.

Exploratory puncture in the face of a suspected tumor is unsurgical, since an incision is more urgently indicated under these circumstances, and when no tumor is at hand, puncture is fraught with the danger of injury to the peritoneum. Exploratory incision and exploratory nephrotomy find their greatest justification in the so-called "essential hæmaturia" where it is not

possible to differentiate between the beginning neoplasm and the calculus. The X-rays were found alike valuable in hard and soft stones.

Therapy.—General treatment is of value in tuberculous affections, but a pulmonary tuberculosis has better chances of recovery when a secondary lesion of the kidney is removed. Exclusion of all irritants from the kidney is a prime indication.

Renal injuries are to be treated conservatively. Ether was found to be less irritating to the kidneys than chloroform. For suture and ligation, fine silk was used.

The author directs attention to the need of revising the names of renal operations. The retroperitoneal posterior incision suffices for all cases, it being stated that even for large tumors the incision was made anteriorly, yet the operation was conducted retroperitoneally none the less. For intermittent hydronephrosis, nephropexy alone may suffice; but in any event it should supplement all plastics. (It is opportune to add here that, following exploration of the kidneys and after nephrolithotomy, a nephropexy should follow, to obviate an eventual floating kidney.)

Though the spontaneous cure of tuberculosis is only possible in rare instances, this does not justify abstaining from operation.—*Beiträge zur klinischen Chirurgie,* Band xxxii, Heft 1.

MARTIN W. WARE (New York).

REVIEWS OF BOOKS.

THE ROLLER BANDAGE. By WILLIAM BARTON HOPKINS, M.D. Fifth Edition, revised. Philadelphia: J. B. Lippincott Company, 1902.

The fifth edition of this well-known little manual presents some notable alterations from its predecessors. In the first place, the illustrations are entirely new, the plates and electrotypes of the former edition having been destroyed by fire. This may be regarded as a fortunate accident, since it has given the author the opportunity of making the illustrations even more perfect than they have heretofore been. Secondly, it has led to a complete remodelling and rewriting of the text. The most notable change resulting from the latter has been the omission of the section on surgical dressings and materials, with the exception of the description of fixed dressings. As it stands now, the book is a most complete exposition of the principles and practice of the art of bandaging and the application of immovable dressings. The statement frequently made that bandaging is a thing which cannot be learned from books may be regarded as absolutely true; at the same time, however, there is no doubt that the principles of bandaging must be learned before the surgeon acquires the art by the practical carrying out of them.

The present edition of the "Roller Bandage," if anything, exceeds in value those which have so well proved their usefulness heretofore. For the student, no matter in what institution he may receive his instruction, this book will be an invaluable companion. To the practitioner, likewise, it can be commended as a complete exposition of the views of a surgeon of great experience on the correct application of dressings which it falls to the lot of

most of us to be frequently called upon to apply. The author has for many years been on the staff of the Pennsylvania Hospital, in which institution there are probably more cases of acute fracture treated than in any other hospital in the United States. From this vast field Dr. Hopkins has drawn the material which he has condensed into its present attractive form. That the present edition will have an even larger success than the former ones can be most surely predicated.

FRANCIS R. PACKARD.

THE PRINCIPLES AND PRACTICE OF BANDAGING. By GWILYM G. DAVIS, M.D. Octavo, illustrated, pp. 146. Philadelphia: P. Blakiston's Son & Co., 1902.

This little book of 146 pages and 163 illustrations has the rare merit of being just what its title indicates and nothing more. In a simple but clear and concise way the writer has described a simple department of surgical technique. Roller Bandages, Tailed Bandages, and Handkerchief Bandages are each in succession considered. The illustrations are abundant, clear, and satisfactory.

L. S. PILCHER.

MINOR SURGERY AND BANDAGING. By HENRY R. WHARTON, M.D., Professor of Clinical Surgery, Woman's Medical College of Pennsylvania, etc. Fifth Edition. Pp. 621. Philadelphia: Lee Brothers.

Minor surgery we understand to include the treatment of such conditions of a surgical nature as do not ordinarily demand general anæsthesia. Abrasions, contusions, incised and lacerated wounds, most fractures, many dislocations, a few amputations, such as fingers and toes, these, with the care of local and general infections, burns, and the various forms of dressings and bandages are appropriately treated of under the title which is given to the book now under review.

Every good treatise on general surgery contains exhaustive chapters on surgical principles, technique, and bacteriology, all of which Dr. Wharton's book also touches on, and there are endless special works dealing with every department in detail.

The Doctor has chosen to include in his present work 156 pages—a third of the volume—devoted to special surgery,—major amputations, excision of joints, operations on nerves, surgery of the gastro-intestinal tract, and other operations in no way to be included under minor surgery, making the book in reality a surgical digest.

Is it not pertinent, then, to ask of this its reason for being under such a title?

There is no need to criticise the substance or workmanship. The work is that of a thorough master of his craft,—careful, conservative, and painstaking. The expression is clear and concise, the illustrations appropriate, and the subject thoroughly modernized.

HENRY GOODWIN WEBSTER.

THE AMERICAN YEAR-BOOK OF MEDICINE AND SURGERY, being a Yearly Digest of Scientific Progress and Authoritative Opinion in all Branches of Medicine and Surgery, under the general editorial charge of GEORGE M. GOULD, M.D. SURGERY. Philadelphia and London: W. B. Saunders & Company, 1902.

Again the surgical volume of this work is submitted for review, and we find it expanded in scope and increased in excellence. The enlargement of the article on General Surgery is especially noteworthy. This section is not only a reasonably complete digest of the year's literature, but is excellently classified, and presented in a readable manner. So abundant is the material gathered from reports of advanced surgery along novel lines that the reader is given an impressive demonstration of the magnificent development of the science. Nor are old lines forgotten.

This portion of the work is exceedingly valuable for reference reading and interesting as an index of surgical progress.

The divisions which are concerned with Obstetrics and Gynæcology are fully written, and summarize many works of great worth. One is here given a group of varying opinions concerning the value of spinal analgesia by cocaine during labor. The recorded advancements in pelvic surgery are largely in the line of refinements of technique. Orthopædic surgery is treated briefly, evidently because of a paucity of material. Ophthalmology and otology are treated comprehensively, and new work for the relief of nasal and laryngeal lesions is capably reviewed. The anatomical chapter tells of some new histological studies, a little new nomenclature, and many anomalies.

The volume is of great value for ready reference to one concerned with the more important recent advances in the departments of which it treats.

CHARLES H. GOODRICH.

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ANNALS OF SURGERY,
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THE TECHNIQUE OF PROSTATECTOMY.[1]

By JOHN P. BRYSON, M.D.,

OF ST. LOUIS, MISSOURI,

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Of the two diseases of the urogenitalia, classified as being essentially obstructive, namely, urethral stricture and hypertrophic enlargement of the prostate gland, the latter is by far the most serious. In both, the pathologic results fall, primarily, upon the bladder, interfering, at first, with the comfort and, later, with the health and life of the individual. If one might eliminate the element of obstruction, both diseases would sink into insignificance; for neither the cicatricial tissue in the former, nor the fibro-adenomatous mass in the latter, can possibly affect the health of the subject. Clearly, then, a study of the pathogenesis and pathology of the bladder lesions offers the best guide to therapeutic adaptation. In order, however, to study the bladder lesions, one must eliminate the element of cystitis, which is not a necessary consequence of obstruction, and also the resulting seminal disturbances, since they, in the face of the larger and more serious consequences to the bladder, sink into a subordinate place.

In stricture we have an example of urinary obstruction, pure and simple, the effects of which upon the bladder, falling entirely upon the muscular coat, determine hypertrophy in its highest degree and purest form. Until the advent of inflammation there are no changes in the mucous lining, or in the

[1] Read at the meeting of the American Association of Genito-Urinary Surgeons at Atlantic City, N. J., May, 1902.

circulation, other than come of the thickening of the middle coat with lessening in capacity, *i.e.*, in distensibility.

In prostatomegaly there is also a urinary obstruction, to which, however, must be added a circulatory obstruction, occurring in the earlier stages, altering the picture and giving greater gravity to the bladder lesions; for, while the overgrowth is encroaching upon the urethral lumen, the swelling mass presses upward and outward about the bladder neck, squeezing the valveless veins of the vesicoprostatic plexus against the fibrous envelope, obstructing the venous drainage of the bladder and determining a venous hyperæmia in its walls which can hardly fail to produce trophic results; so that, in prostatomegaly, we have both a urinary and a circulatory obstruction.

Sufficient importance has not, it appears, been attached to this venous obstruction and its effects upon the nutrition of the bladder-wall in accounting for the symptomatology and pathology of the bladder changes in prostatics. In the writer's opinion, it constitutes one of the chief factors in the evolution of the condition known by the collective term prostatism.

In simple urinary obstruction we observe, long before the advent of inflammatory changes, simple, uniform hypertrophy of the middle coat with, in the earlier stages, a corresponding reduction of distensibility. For the most part, trabeculation and the tendency to sacculation are absent. When we have occasion to do epicystotomy in these cases, even in old men without enlarged prostates, we observe, on exposing the anterior vesical wall, no unusual varicosities. Symptomatically, nocturnal frequency is entirely absent, and, for the most part, diurnal frequency is not noticeable, while exercise is apt to increase the latter. Vesical atony and residual urine are rare and occur only in the later stages.

In prostatomegaly, trabeculation, sacculation, atony, distention, and residual urine are, among the observed conditions, so common as to constitute the chief foundation for diagnosis; while enormous dilatation of the vesical plexus and its afferent veins is so prominent as to elicit mention by the anatomists.

(Quain's "Anatomy," Vol. iii, No. 4, p. 248.) Symptomatically, nocturnal frequency is almost, if not quite, pathognomonic, while exercise and all other aids tending to improve the general and local circulation are well known to lessen frequency and reduce vesical distress.

Furthermore, removal of the obstacle to urination in stricture is promptly followed by disappearance of the hypertrophy of the middle coat, which is its only pathological consequence; while removal of the urinary obstruction in prostatics by catheterization is followed by only a partial involution of the more profound and complex bladder changes which have been wrought. Epicystotomy in a considerable number of prostatics who have been in catheter life for a long time has impressed the writer with the conviction that the removal of the urinary obstruction in these cases has but slight, if any, effect upon the circulatory disturbances. Large, tortuous, and engorged veins have been as frequently seen in these cases as in those where the catheter had not been resorted to; while in one case requiring epicystotomy, five months after a perineal prostatectomy, this condition of the vessels was notably absent.

In the coarse anatomicopathological observations, made during fourteen years of operative work, the impression has been gained that, so far as concerns the muscular coat of the bladder in prostatics, it is the pathological field where atrophy and hypertrophy, degenerative and regenerative changes are contending. The marked development of the inner fasciculi suggests hypertrophy, while the thinned subfascial bands, without trabeculation, offering little or no resistance to herniation of the mucous coat, give the impression of atrophy. Often—indeed, nearly always—the picture is obscured by the appearances ordinarily found in inflammation; but when one observes, on exposing the anterior wall of a distended bladder, several cystlike vesicles, easily passing between large and strong inner muscular bands, spreading out like coins under the thin vesical fascia, changing their size with respiration, and finally disappearing when the bladder is opened, the im-

pression is irresistible, and one may have a wish to see the matter investigated without going so far as to say that these appearances, which have been observed only in prostatics, seem to bear a certain relation to the evidences of venous obstruction. Whether or not such investigation would bear fruit, it is quite certain that the pathological conditions of the bladder in prostatics when compared with those in simple, non-obstructive cystitis and with stricture cases, offer distinct evidences of difference for which explanation is sought, and which may not be found so long as we regard them as being essentially inflammatory, giving too little heed to those etiological influences which, as the combined results of urinary and circulatory obstruction, precede the cystitis by a long period. To this point S. Alexander has already called attention with insistence. Nevertheless, since cystitis is a frequent link in the pathologic chain of prostatism, the surgeon seeking technical guide, neither wonders nor regrets that the pathologist takes it as the starting-point of his investigation; all the less so since he is compelled to work backward towards its etiology.

If objection be made that the retrogressive nutritional changes in the muscular coat are due to the substitution of the catheter for normal micturition, thus nullifying the function of the detrusor, one at once calls to mind the fact that these changes are seen also in the bladders of prostatics who have never been in catheter life. Moreover, the mere expulsion of urine is not the only incentive to muscular contraction of the bladder. Cystoscopy has familiarized us with the fact that the bladder is, normally, in as active a state of peristalsis as a coil of intestine which is drawn out of an abdominal incision. Besides maintaining a slight tonic contraction upon the contained urine, peristaltic waves are constantly coming down the ureters and spreading over the vesical wall. These waves originate also in other parts of the bladder, to spread in different directions, constantly changing the degree of tension. Physical efforts and mental emotions (Griffiths in the *Journal of Anatomy and Physiology*, 1894-95, p. 254), changes in the character and reaction of the urine (Ashdown, ibid., Vol. xx, p. 299),

are additional excitants to this peristalsis, so that we must regard the muscular structure of the bladder as in a constant state of activity.

Clinically, we have opportunity to observe this notably in cases of distention where we find intermittent, colicky cramps, even in greatly distended bladders. It is probably to this muscular activity, many times increased, that we must attribute the hypertrophy observed in cystitis without urinary or circulatory obstruction.

It is plain then, that, whether or not we eliminate inflammation, the pathological lesions of the bladder in prostatics are, when contrasted with those resulting from urethral stricture, more profound, more complex, and more distinctly associated with retrogressive nutritional changes; and, relying upon the gross anatomicopathologic observations made during the course of operative work, one must naturally refer these differences to the venous hyperæmia which is so striking a feature in prostatic as compared with stricture cases.

Turning to the more highly specialized histopathology, we see this difference even more accentuated. In an admirable contribution by Noel Halle and B. Motz,[1] conclusions based upon a study of 100 bladders of patients who have succumbed to chronic inflammatory affections of the urinary apparatus are presented. The cases include simple, non-obstructive cystitis, as well as cystitis occurring in stricture, and prostatic cases. Concerning the last named, they say in part: "With prostatics, the chronic inflammatory processes, together with the obstacle to the flow of urine, are not sufficient to explain all the conditions. Difficulties of retrogressive nutrition, due to senility, enter into the pathogenesis of the lesion."

"The vesical capacity, generally increased, is a direct result of the prostatic obstruction, acting primarily a long time before the invasion of the cystitis upon senile bladders whose tissues suffer from diminished resistance."

[1] "Contribution to the Pathological Anatomy of the Bladder," Noel Halle and B. Motz, Annales des Maladies des Organes Génito-Urinaires, January and February, 1902.

"The muscular hypertrophy is not regular and complete; it predominates always in the internal plexiform layer; often it is limited to this layer alone. The columns which are characteristic of prostatic bladders are due to this hypertrophy. The fasciculi of the middle and external muscular layers, sometimes even diminished in volume by simple atrophy, lie embedded in a mass of abundant conjunctive tissue, loose, and often infiltrated with soft fat."

"We find, then, in this change in relation between the muscular and interstitial conjunctive tissue, the anatomical reason for vesical atony or insufficiency which we meet in prostatism."

"These lesions come, not from the chronic inflammation nor from the obstacle to the flow of urine, but are primary, trophic lesions of which age seems to be the only appreciable cause."

"We do not believe that the atrophy is primitive, but that the hypertrophy first takes place, rapidly followed by atrophy in the aged subject whose tissues are in a state of insufficient nutrition."

"In accord with Bahdanowicz and Giechanowski we think that the first cause of the lesions can be sought for in the primitive pathological lesions of the vessels of the bladder, arteriosclerosis, periarteritis, etc. We have noted no lesions of the nerves capable of explaining the degenerations."

In view of the observations of the pioneers in prostatectomy, Belfield and McGill, that apparently hopelessly diseased bladders of prostatics may be restored almost completely by operations which have been abundantly confirmed by subsequent observers, one may venture to ask if some, at least, of these conditions (sclerosis and atrophy) may not be accounted for by the venous hyperæmia which characterizes prostatic cases. The writer has seen this restoration occur in cases presenting all the characteristics of senile heart and arteriosclerosis.

If the foregoing is a correct estimate of the etiology and pathology of the vesical conditions in prostatism, it appears

that an adequate technique must include the removal not only of the urinary but equally of the circulatory obstruction; and that an operation which deals with only one of these is incomplete.

As this paper is intended to deal only with prostatectomy and its indications, it is not necessary to consider other operative procedures, further than to state that the two factors in the etiology of the disease vary greatly in their relations to each other in different cases; and that theoretically as well as practically these variations must have weight in the choice of operation. Moreover, there is no intention here to draw the *a priori* deduction that the modern electrocautery-prostatotomy necessarily deals alone with urinary obstruction, since with our present knowledge it is not possible to determine its effects upon the bulk of the gland.

As a matter of history, fourteen years have been required for the development of prostatectomy to its present incomplete state; and in the minds of many surgeons it is still on trial, while not a few regard it as unjustifiable. In the beginning (1888) the suprapubic route was the only one employed, and the operation of Belfield and McGill was incomplete, the results unsatisfactory, and the mortality high. As a matter of fact, one had to content himself with the removal of the intravesical projections with only such portions of the posterior part of the gland as could be reached from the vesico-urethral isthmus. To remove growths situated farther down the urethra, or even those immediately under the ring of the vesical neck, required an incision into the neck of the bladder, and this, experience soon taught, was full of the gravest dangers, primarily from hæmorrhage and secondarily from sepsis. The pain and vesical cramps excited by the pressure of gauze pads in the sensitive bladder necessitated the exhibition of morphine, often required perineal urethrotomy, and interfered with aseptic irrigation, all of which rendered the operation more hazardous, while complete prostatectomy was as yet not obtained.

It soon became apparent that if there were prostates which, for operative purposes, could not be reached from the perineum,

there were also prostates that could not be reached from the bladder, which led Belfield to practise and advocate the combined suprapubic and perineal incisions. This most important step in the evolution of the technique was the beginning of perineal prostatectomy, especially as it led to the demonstration that excochleation with the finger or a blunt instrument was possible, that it resulted in a great saving of time and reduction of hæmorrhage, while it afforded improved drainage.

The incision by which the prostate is to be reached from the perineum will probably depend largely upon whether the growths are to be attacked from the urethral or the capsular side of that body. Freely admitting the influence, in his own work, of the personal factor, the writer has not thought it advisable or necessary to follow, in any of his cases, the method of Von Dittel in his "cuneiform resections" by the "lateral" prostatectomy, nor that of Warhalm by the semicircular perineotomy incision, for the reason that it did not appear advisable to precede one serious operation by another which cost blood and time. The growths have invariably been attacked from the urethral side for the reason that this was the most direct, that urethrotomy was necessary for vesical exploration, and fewer important structures were disturbed and fewer avenues to infection opened. Experience gained in doing a number of operations by the combined suprapubic and perineal incisions had convinced him that the fear of removing a considerable part of the floor of the prostatic urethra was groundless. Seeing that on four occasions he has removed, in perineal prostatectomy, vesical calculi which before the operation could not be touched with the stone searcher nor seen with the cystoscope, and which were without a subjective symptomatology, he found himself in accord with those who believe that a prostatectomy which does not permit at least of digital exploration of the bladder is likely to prove insufficient.

Since this is, in some measure, a record of experience, it is permissible to say that up to the present time a simple and free median perineal urethrotomy has given ample room for

work, even in the case of very large prostates; hence the Y-shaped incision has not been employed. In the main, therefore, he finds himself in accord with the practice of Belfield, McGill, Alexander, Nichol, Fuller, and others who have done so much to bring the technique of the operation up to its present state, and to stimulate the present gratifying interest in prostatic surgery. If there were a question as to the value of the work done, one would have but to point to the single fact that we

FIG. 1.—Penis omitted to show incisions.

have seen the operative mortality sink from 25 per cent. to probably less than 6 per cent., while there has been almost as great gain in the degree and permanency of the relief afforded to a class of old men beside whom we stood but yesterday all but helpless.

With such modifications as seem demanded by special conditions, the technique now practised is as follows:

The anæsthetized patient, whose perineum and abdomen

have been prepared as for a cœliotomy, is placed in the lithotomy position, a catheter introduced, the bladder irrigated with warm boric acid solution and filled with warm salt solution to a point just below that which produces distention-reflex. A broad, grooved staff is introduced, and a free, median, perineal

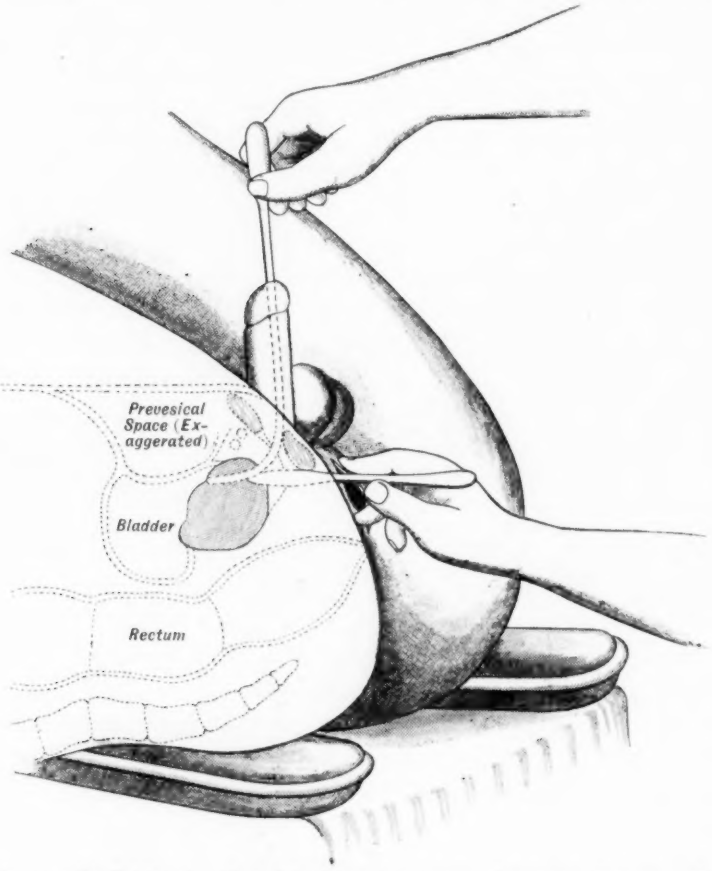

FIG. 2.—Staff introduced and incision into apex of prostate being made.

incision (Fig. 1) made in such a way as to open the urethra just in front of the apex of the prostate. Most frequently the bulb is split, in which case a spurting vessel is clamped or an oozing is stanched by a catgut suture *en masse*. The knife, after entering the groove of the staff, is pushed backward far

enough to incise the ring at the apex of the prostate (Fig. 2), which is one of the least distensible parts of the duct. The forefinger follows well into the prostatic urethra, usually tearing it somewhat, and the staff is withdrawn. The finger quickly explores the prostatic urethra and ascertains whether the vesical outlet can be reached, after which the forefinger of the right hand in the rectum permits bimanual exploration of

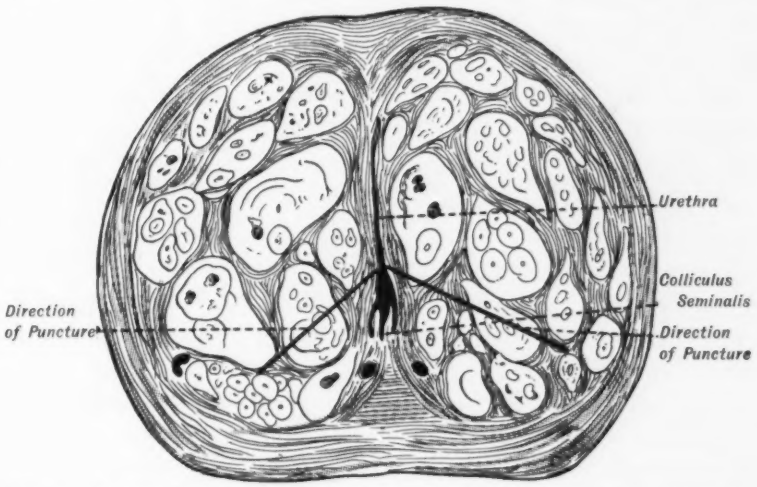

FIG. 3.—Transverse section through centre of hypertrophied prostate to show lines of puncture. Here it may be seen that the hypertrophied tissue may be removed without injury to the proper capsule or entering the fibrous sheath formed by the pelvic fascia. If all the urethra below the points of puncture were removed, its lumen would not be seriously abbreviated.

that part of the prostate within reach. Guided by the finger, a blunt instrument is now passed into the urethra and made to puncture, from the urethral side, the lowermost part of the mass. This puncture is always made in the lower posterior quadrant, and the instrument is pushed well into the swelling (Fig. 3). On its withdrawal, the finger tears its way into the centre of the mass (Fig. 4), which, even in fibrous prostates, is comparatively friable. The mass is now opened through to its capsule, the finger swept round its periphery without tearing the prostatic capsule or fibrous sheath of the

gland. In the meantime the urethra is felt to tear longitudinally. After the lobe has been loosened all around, there remains its attachment to the urethra, in detaching which care must be had not to take away too much of the sides nor any of the roof of the urethra. The floor may be disregarded if necessary. The hypertrophied lateral lobe is then removed,

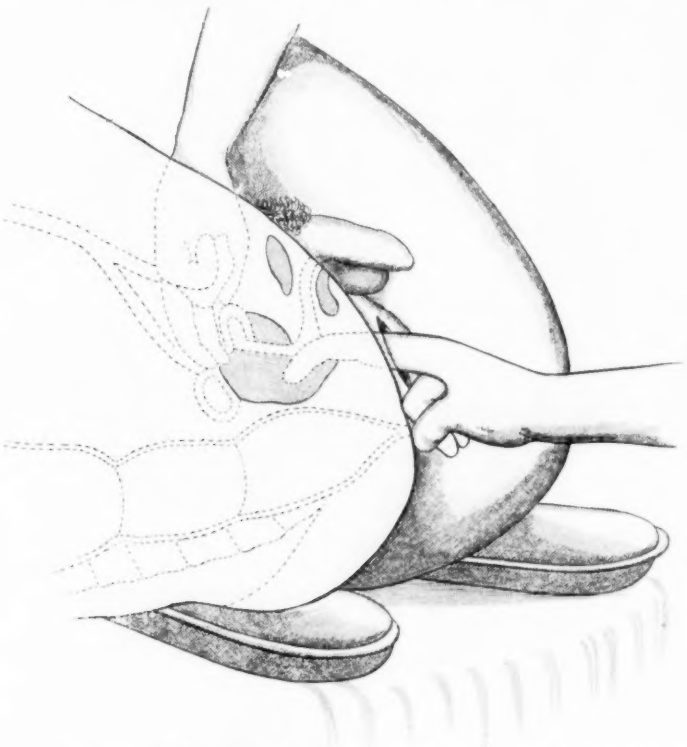

FIG. 4.—Showing forefinger of right hand enucleating while first and second fingers of left hand are making counterpressure from space of Retzius; neither the bladder nor peritoneum have been opened. (See Case I.)

to do which one has often to go well up beside and behind the neck of the bladder; yet it is possible to do this and keep within the capsule. Very little bleeding follows; but what there is appears to come from the torn mucous membrane, the lower part of which is brought away. If there be any difficulty in de-

livering the detached mass, which is often smooth and slippery, an ordinary lithotomy-forceps may be employed. If it is too large, it may be broken up with the finger or divided with the scissors.

This process is repeated on the opposite side, after which a median posterior segment sometimes remains to be dealt with. This can usually be done by sweeping the finger from side to side, its dorsal aspect towards the capsule, pushing it backward in such a way as to detach it well up behind the bladder and roll it downward. One may be surprised to find that he can get behind and excochleate what he had just felt as a pedunculated, intravesical projection, or a growth *en collerette*, bringing it well down by use of the forceps apparently without disturbing the fibrous ring at the vesical outlet. Most frequently one finds the attachment of this mass to the urethra quite firm; and, no matter how much care is taken, some of this membrane is brought away. The more the detached mass is rolled downward by pulling upon its upper surface, the less mucous membrane is removed. In some cases the whole of the floor, including the colliculus and verumontanum, has been removed without subsequent harm; in fact, in most of these cases this has been necessary, the explanation of which may be found in the anatomic fact that the collecting tubes of the prostate gland, passing from the lateral lobes, and, if there are any, from the median portion, as well as the ejaculatory ducts, unite here and empty into the sulci on either side of the verumontanum, while the colliculus often passes deeply into the tissue,—showing also how it is that those who practise excochleation from the capsular side find it necessary to make a hole in the urethra at this point, or to cut the pedicle with knife or scissors. Usually, the finger may now be passed with ease through the ring into the bladder, which, being emptied with the catheter, may be explored thoroughly, aided by pressure made by an assistant or by the disengaged hand, over the pubes. Fully relaxed by the anæsthetic, even fat men with protuberant bellies sometimes lend themselves to this procedure. In this

way stones have been discovered and removed by forceps, and in one case the opening to a herniated pouch has been entered.

If the operation is found to be complete, the cavity is now irrigated with a hot salt solution, until the oozing, which is usually slight, ceases, after which a finger is introduced and finds the floor and, for the most part, the sides of the urethra intact, the latter often hanging loosely against the outer sides of the cavity from which the growths have been removed. A large cavity is made out, between the lower part of which and the rectum there is felt a thin wall. Into the lower part of this, hinged posteriorly about the ring at the vesical neck, is an irregular flap of mucous membrane, which can be pushed up and back and often made to occlude the vesical outlet. The walls of this cavity feel rough, irregular, and often shreddy, nevertheless, they do not seem to be a poor basis for "taking" of a graft; for it seems that, if properly managed, this tongue of mucous membrane readily becomes attached, behaving subsequently like an autoplastic flap. Care must be taken not to double backward and push this flap into the bladder when, as is now done, the large drainage tube is introduced, the wound edges retracted and the cavity packed with gauze, loosely or tightly, as may seem necessary to provide against subsequent hæmorrhage. In packing, one naturally takes account of any oozing point, usually found about the edges of the mucous membrane.

Formerly, enucleation from the perineum was not begun until we were assured that the finger could reach the vesical outlet and even enter the cavity of the bladder; but subsequent experience has modified the practice in this respect. Emboldened by the consideration that at any stage of the operation by the lower route one might cut into the supravesical space or even do an epicystotomy, excochleation has commenced as soon as the finger reached well enough beyond the prostatic apex to afford working space. In several instances it has happened that, as the lower portions were opened and removed, there was a sinking down of the base, which went on as the operation progressed until pressure from above easily brought

the neck of the bladder within reach, so that a finger could be hooked behind the ring. This might, it now appears, have been inferred *a priori*. It is the posterior layer of the deep perineal fascia which offers resistance to the downward growth of the gland; hence it is the enlargement of the lateral lobes which elevates the vesical outlet and stretches the prostatic urethra. This prop being removed, the result is all the more obvious, since we know that the anatomical, as distinguished from the pathological, perineal distance does not vary sufficiently to place the neck of the bladder beyond reach of the finger. Furthermore, we are aware of the fact that these growths are in a state of tension even after death, and probably more so during life, so that we may infer that something is gained in the shortening of the prostatic urethra by the natural tonus of its longitudinal fibres once they have play, and even more by intra-abdominal pressure when the obstacle is removed. Working from below, one is sometimes surprised to find that a thick panniculus and protuberant belly are not great obstacles to the efficient employment of hypogastric pressure.

Working in this way, it has been found in practice that there remains a smaller and apparently decreasing number of cases which require extraordinary appliances or additional operative procedures for the purpose of bringing the bladder within reach from the perineal incision. Hooks, volsella forceps, elastic balloons inflated after having been introduced into the bladder, etc., have been ingeniously devised and used by some, while epicystotomy and even cœliotomy have been practised by others. It was the confidence inspired by the efficiency of the method practised in the following case and repeated in several subsequent ones which later on made it seem justifiable to begin the operation of enucleation even before the vesical outlet came within reach.

CASE I.—A. B., whose bladder had been drained without relief for eighteen months by an epicystic fistula, was operated upon by the perineal incision on December 3, 1898. Failing to reach the bladder with the finger, fearing to begin excochleation

before this could be done, and realizing the necessity of rapid work on account of a well-defined aortic stenosis which rendered anæsthesia hazardous, an incision was made through the abdominal wall into the prevesical space, without opening either the peritoneum or bladder. The bladder having been emptied by a catheter, it was found that two fingers introduced into the space of Retzius (Fig. 4) easily enabled the prostate to be depressed and excochleation to be done, securing the removal of over 600 grains of tissue, a considerable part of which formed an *en collerette*, intravesical projection. The rapid closure of the fistula seemed good evidence of the thoroughness of the prostatectomy which the subsequent condition of the patient confirmed; frequency, dysuria, pyuria, and residual urine disappeared, all of which had persisted despite the suprapubic drainage.

Since doing this operation, all prostates and parts of them, whether of lateral lobes or intravesical projections of the median or posterior portions and whether epicystotomy had been previously done and had afforded opportunity for intravesical work, have been excochleated and delivered by the perineal incision. Experience gained in the course of this work has confirmed the initial impression that incision into the supravesical space should be postponed to the latter part of the operation, since even in the case of quite large prostates it may not be necessary. While further observation is required in order to determine the question, the impression has been gained that it will most frequently, perhaps only, be required in the case of extensive and pedunculated intravesical projections, if indeed these last named exist to the extent and frequency now believed. In the case of sessile and *en collerette* projections, one may be surprised to observe the ease with which they may be shelled out from beneath the trigonal space. In two personal cases, and in one of Dr. Willard Bartlett's, in all of which it had been necessary to do a preliminary epicystotomy, the finger in the bladder was able to feel the excochleation proceeding from the lower incision and working high up under the trigone. After working in this way, one is inclined to ask further proof than is now at hand of the degree

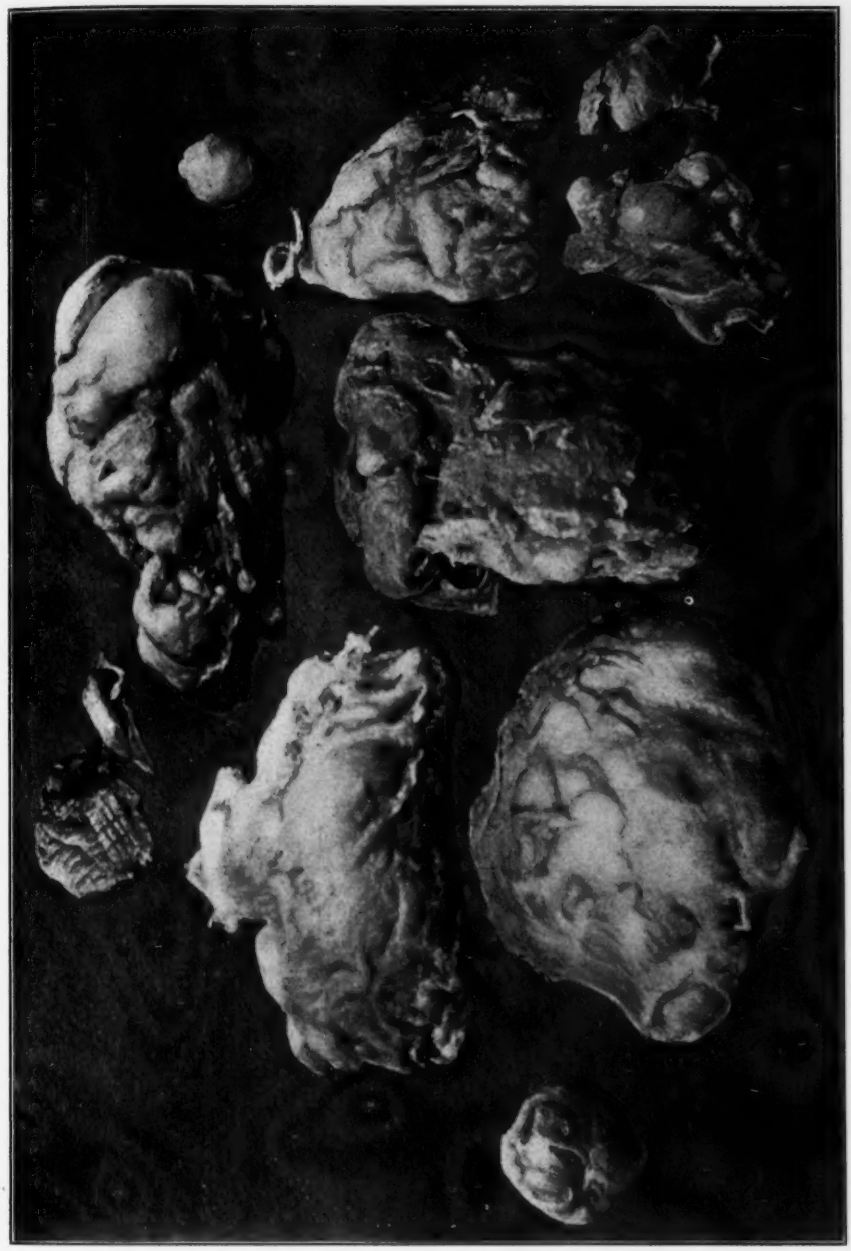

FIG. 5.—Nineteen hundred and twenty grains (four ounces) of prostatic tissue (see Case II) removed by perineal route. Natural size after having been kept in 4 per cent. formol solution for six months. Estimated shrinkage, 20 per cent.

of pedunculation and the extent to which it may prevent enucleation from below. One may, indeed, especially when doing prostatectomy by the combined perineal and epicystic incisions, make an autopsy *in vivo,* and so this question is not impossible of solution. Seeing the danger incident to incising the vesico-urethral ring either from above or below, viz., hæmorrhage, septic phlebitis, and subsequent dribbling of urine, the matter is not unimportant in its bearing on the question of modification of the technique. In one personal case it was thought necessary to pull down and twist off such an intravesical projection, and in another to incise and peel out a mass about the size of a hazel-nut, and in both cases hæmorrhage gave anxiety and necessitated close and painful packing. These were among the earlier experiences in complete enucleation from below; it is now believed that they could have been dealt with from beneath the bladder-wall.

As modifying the technique described above, the question of the size of the prostate which may permit delivery by the perineal incision, and the kind of incision which is primarily made and subsequently enlarged, has importance. This will in some measure be determined by whether one wishes to remove the prostate in one mass or by morcellation. Since there has appeared no satisfactory objection to piecemeal excochleation, this has been done, and so the simple, median perineal incision has been found adequate up to the present time.

Case II.—Dr. T., aged sixty-four years, required suprapubic puncture and aspiration for retention which could not be relieved by catheter. The severity of the local and the gravity of the systemic symptoms were such as to require epicystotomy on September 20, 1901. Eight days later, both local and general conditions having improved, perineal prostatectomy was done, and 1920 grains (four ounces) (Fig. 5) of adenofibroma removed, entirely by the perineal incision. Epicystic wound healed in twenty-three days. Recovery with satisfactory result, except for slight leaking when the bladder was quite full. In January, 1902, there was no residual urine. Up to the time of the acute retention, the catheter had never been used.

Since fourteen years of prostatectomy by the suprapubic and combined suprapubic and perineal incisions have not sufficed to determine the question of the duration of the relief and the probability that portions of hypertrophied tissue remaining after operation may continue to grow and in time obstruct both urine and circulation, it cannot be hoped that less than four years of the more complete and radical perineal operation shall have furnished evidence sufficient for a solution of the problem. If one's impressions were of value to scientific research, it might be said that the modern operation is more complete, and therefore more likely to prove, in this respect, satisfactory. Something more like direct observation attaches to the following cases:

CASE III.—G. W. E., aged sixty-six years, with complete catheter dependence, required prostatectomy on January 12, 1895. By suprapubic operation, in forty minutes ninety-six grains of adenofibroma were removed, consisting chiefly of irregular intravesical projections. Convalescence required thirty-one days. Relief, never quite complete, for three years, when nocturnal frequency and dysuria again required the catheter. In another year there was complete dependence upon the catheter, with cystitis and pain on distention. September 28, 1901, perineal prostatectomy was done and 300 grains of tissue (Fig. 6) removed in twelve minutes. Urine passed by urethra on eighth day; nocturnal urination ceased on the eighteenth day, and patient was discharged on the twenty-first day without residual urine. Patient was confined to bed only seven days. Reports April 12 that condition is satisfactory, that he does not rise at night to void, and has not used catheter.

On the question of the relative thoroughness with which the operation can be done by the two routes, the following evidence may be presented.

CASE IV.—Specimen from E. J. G., aged sixty-two years, operated on (suprapubic route) in 1896, one year after castration had been done without relief, and 144 grains of tissue—chiefly

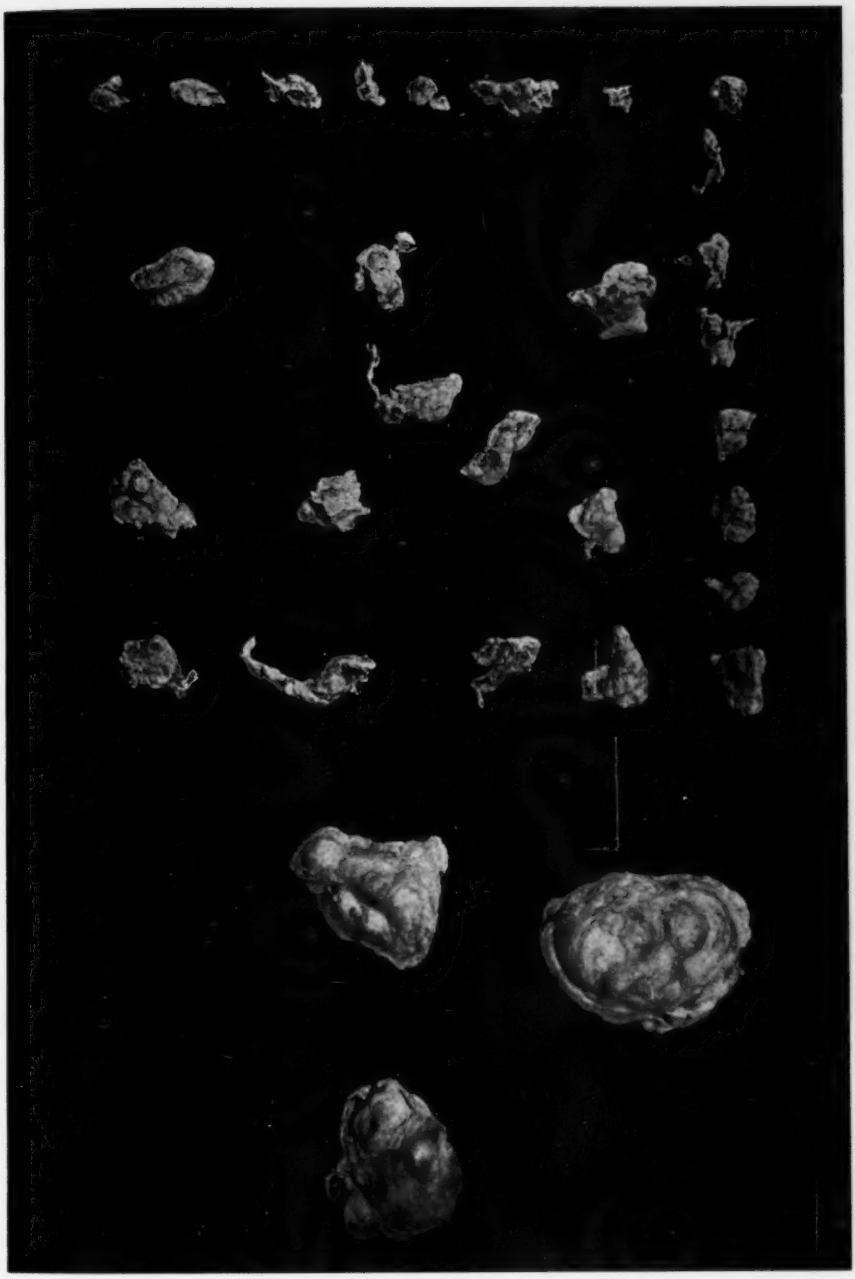

FIG. 6.—The twenty-eight small pieces in upper part of picture weigh ninety-six grains, and were removed by the suprapubic incision, chiefly with rongeur forceps, in 1895. The three larger pieces in lower part of picture were removed, by perineal section, in twelve minutes, six years later. They weigh 300 grains. (See Case III.)

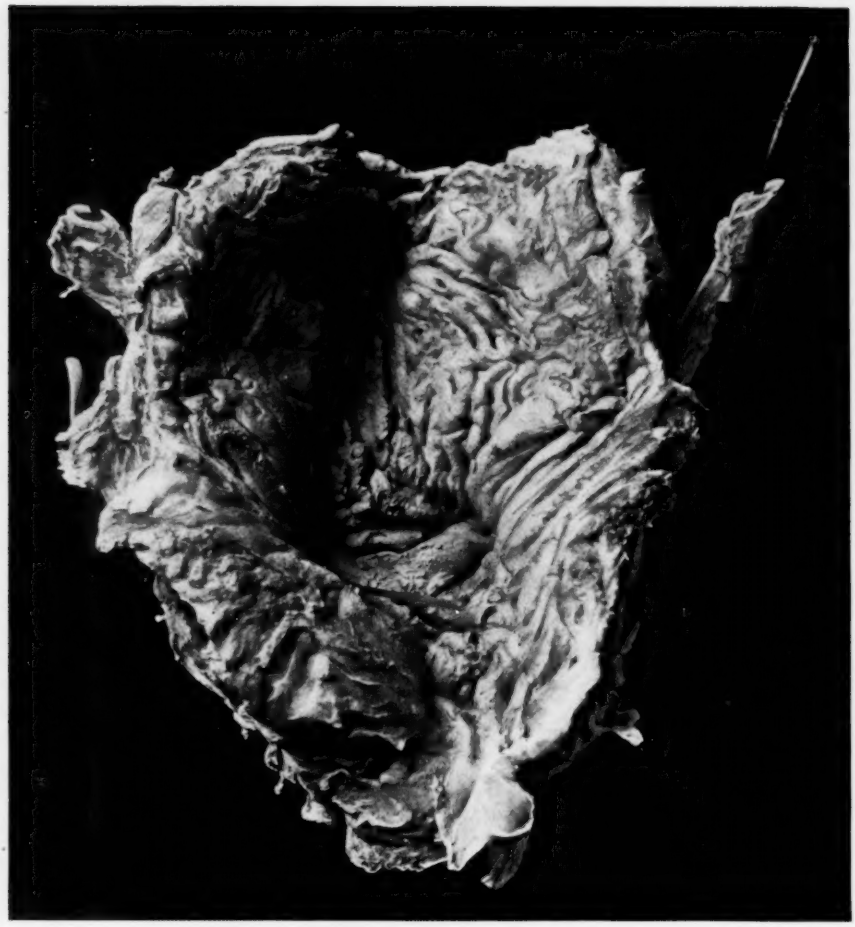

FIG. 7.—Illustrates incomplete prostatectomy by suprapubic section. Specimen, much shrunken by preserving fluid, shows two healed incisions on the sides and floor of prostatic urethra, through which 144 grains of prostate had been removed with rongeur forceps. Probably half of the gland tissue remains, the anterior part and the verumontanum being intact. (See Case IV.)

adenomatous — removed through two posterolateral incisions, which may be seen just healed (Fig. 7). Rongeur forceps was used, and it was believed at the time that the prostatic capsule had been practically emptied. This, as may be seen, is not true. There remains, probably, about one-third of the hypertrophied mass. The patient made a rapid recovery, the epicystic incision closing in fifteen days, but died subsequently of a heart trouble.

CASE V.—S. W., aged seventy-two years, subject of extensive arteriosclerosis, cyanosis, and tachycardia. Operation, perineal prostatectomy in twelve minutes on April 8, 1901, resulted in the removal of about 600 grains of tissue from the sides, floor, and posterior median part of the urethra, some of which was an *en collerette* projection. Ten months later, the patient succumbed to an intracranial hæmorrhage, preceded by hæmaturia and melæna.

The specimen (Fig. 8), otherwise quite interesting on account of the symptom complex associated with the large herniated pouch, is presented here to show: (1) that the prostate has been quite extensively removed, only a small portion of the left upper quadrant remaining; (2) that the floor of the urethra, about one-third of which was removed, has been reformed, the new mucous membrane being apparently adequate; (3) that there is but a thin rectovesical septum remaining, though before the operation there was felt a thick bulging mass of prostatic tissue; (4) that the "ring" of the vesicoprostatic isthmus with its lining membrane is quite intact, though a considerable mass of prostatic tissue was removed from behind it and from well up under the anterior angle of the trigone, and that all tissue capable of acting as an obstacle to both urinary and venous drainage has been removed. As a matter of fact, if we put aside the systemic condition which finally caused the death of the patient and the vesical symptoms due to the large herniated pouch, there remains, as to the ultimate effects of the operation, only the doubt whether enough prostatic tissue has been left to grow finally into an obstruction to urination. That the obstruction was once a considerable one seems to be demonstrated by the formation of a pouch

capable of holding nearly as much as the bladder from which it springs.

That the anatomical conformation of the hypertrophied tissue necessitates a modification of the technique, and that other associated conditions, notably catheter dependence, degeneration and cystitic, ureteritic and pyelonephritic complications may demand preliminary operative invention, the following case, among others, seems to indicate.

CASE VI.—E. J. S., aged seventy years, had been at first partially, and later totally, dependent upon the catheter for five years.

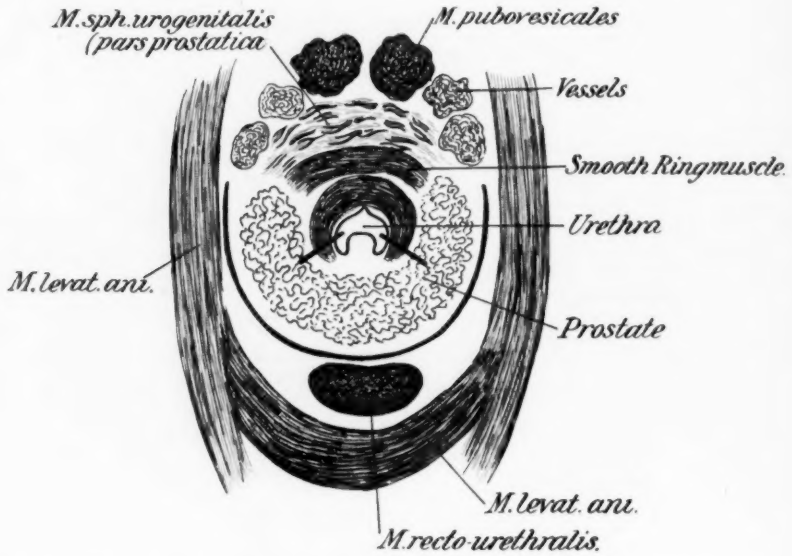

FIG. 10.—Diagram copied from Dr. Otto Kalischer, representing transverse section through middle of prostate. The heavy, black lines show how the incisions advocated in the paper avoid injury to the voluntary (red) and involuntary (blue) muscular structures of the parts. (DIE UROGENITALMUSKULATUR DES DARMES, Berlin, 1900, p. 44.)

Bladder degenerated, almost without trabeculation, atonic and chronically inflamed. Perineal prostatectomy in five minutes on March 2, 1901. Removal of 140 grains of tissue was followed in eight days by perineoscrotal erysipelas; infection by nurse. The tedious recovery from this left the patient unrelieved of the

FIG. 8.—Case V shows almost complete removal of prostate by perineal route, only a small portion of the upper left quadrant remaining. Urethral floor completely restored and all obstruction to urination removed. Compare with Fig. 7.

FIG. 9.—Case VI. The two larger masses were removed at first operation by perineal section. Four months later the upper smaller mass was removed, by the same incision, from beneath and behind the vesico-urethral ring. Epicystotomy and drainage required for restoration of vesical function. Masses about two-thirds of normal size.

vesical distress. Abscesses and the persistence of the perineal fistula led to reopening of the perineum, when a small nodule was felt and removed from beneath the left urethrovesical ring (Fig. 9). This was done in July, four months after the first operation, and was followed by no relief of the vesical symptoms. Two and one-half months later symptoms of cystolithiasis making their appearance, an epicystotomy was done. Suprapubic drainage for one month resulted in satisfactory cure, with no residual urine and only a faint pyuria.

It remains to be said, in connection with the technique, that experience in this and other cases has led to the practice of doing, in four cases, a preliminary epicystotomy for drainage and the treatment of bladder and kidneys, and to the conviction that, when epicystotomy is demanded at all in prostatism, it is an advantage to do it as a preliminary operation, and that this practice seems likely to materially reduce the mortality in that large class of cases coming for relief in the terminal stages of a surgical disease which is of serious import even in its inception.

THE PRERECTAL CURVILINEAR INCISION FOR PROSTATIC ABSCESS; WITH A REPORT OF THREE CASES.[1]

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THE many-sided studies which the operative surgery of prostatic hypertrophy has received during the last two decades have of necessity thrown an indirect light on the allied subject of prostatic abscess. Of recent years, the latter has not received much direct consideration, perhaps because of the relative infrequency of such abscesses, or because their treatment was considered a closed chapter. If we exclude the acute follicular suppurations of the prostate which attend gonorrhœa, suppuration within the parenchyma is relatively rare. It is certainly so with regard to those cases that become the object of operative interference. An examination of the reports of large general hospitals will show that the experience of every surgeon must be limited in the matter of parenchymatous prostatic abscesses; that, too, whether they be of gonorrhœal, metastatic, tubercular origin, or appear as a complication of hypertrophy. The report of the Massachusetts General Hospital for eight years shows only thirteen cases of acute prostatitis, in a total of 25,000 surgical patients. Several of these acute cases were not designated as prostatic abscess.

That these abscesses are sometimes overlooked cannot be questioned. Fortunately, the symptoms both local and general indicate both the nature and seat of the trouble in most cases. In others, however, the abscess assumes a latent form,

[1] Read before the American Surgical Association, June 2, 1902.

where, without functional disturbance of either urethra or bladder, periprostatic phlegmons of gravest omen are developed. Recently, there was admitted to my ward in the Cincinnati Hospital a man of sixty, who was moribund from septic infection. The autopsy revealed an enormous phlegmon of both ischiorectal fossæ, a gangrene of the anterior rectal wall, and a sloughing prostate gland. Running free through the large cavity were two inches of the intact urethra. The vital resisting power of the urethral wall under stress of sloughing processes around and about it, as seen in extravasation of urine, is often observed. It is a factor to be considered in all perineal operations on the prostate, to which reference will be made later on.

Regarding the diagnosis of prostatic abscess, when the condition is once suspected, there is but little difficulty. The rectal touch, which is never neglected by the surgeon in pathologic conditions of the male pelvis viscera, is, unfortunately, not so often made by the busy practitioner. Therefore its diagnosis is at times not made until invasion of the rectovesical fascia has taken place. But this very invasion decreases the value of the rectal touch for accurately determining the condition of the prostate gland. When once the finger feels a soft, indentable, fluctuating spot underneath the rectal mucosa, it can no longer be determined to what extent the suppuration is intra- or periprostatic. The importance of this observation seems emphasized by the compilation of Segond;[1] in forty-three out of sixty-seven cases, the abscess pointed in the rectum. Furthermore, the value of the rectal touch is diminished in the abscess complicating prostatic hypertrophy. Fortunately, this is counterbalanced by the prominence of other signs, notably, the intermittent urethral discharge which makes the recognition of the secondary infection relatively simple.

A very large proportion of prostatic abscesses, if untreated, open into both rectum and urethra (twenty-one out of sixty-seven). Such cases are either rapidly fatal, or, if recovery ensues, leave urethrorectal fistulæ that are often beyond relief. A dominant factor in determining the method of at-

tacking a prostatic abscess must always be the relation this bears to urethra. In fifty-five out of 115 cases, the abscess opened spontaneously into the urethra or was opened by the beak of a passing instrument. It is self-evident that in this category would be found a large number of follicular abscesses, or such at any rate as would not be deeply placed within the parenchyma. How frequently the urethral drainage of even these superficial abscesses is insufficient is manifested by the chronicity of the discharge and the recurrence of retention symptoms.

Whatever the primary source of their infection, deep-seated prostatic abscesses develop within the gland substance without entangling alliances with either urethra or rectum, although, with the growth of the abscess, there is a tendency to open into either channel in the order given. How this affects the operative treatment of prostatic abscesses seems plain. To go in between urethra and rectum is the direct inference. Nevertheless, the urethral or rectal routes are still recommended. In what I believe is the last edition of Harrison's [2] classical work ("Surgical Diseases of the Genito-Urinary Organs," p. 277), he recommends that the abscess be opened with a urethral sound guided by a finger in the rectum, and has a full-page illustration of the method. Only when the whole prostate is involved does he advise a median perineal incision. The use of the Bottini incisor, recently advised for the same purpose, is a technical improvement of the intra-urethral operation, but based on the same principles, which I believe to be wrong. On the other hand, the transrectal incision of prostatic abscesses still has many advocates in higher quarters. Of two cases from the Heidelberg Clinic of 1902, one was operated on through the rectum.[3] Guiard [4] and Routier,[5] who perhaps reflect the views of many French surgeons, regard the rectal incision as the normal one for opening prostatic abscesses. This seems the more strange in view of the favor which perineal prostatectomy has found with the foremost genito-urinary surgeons of France.

The very gratifying results recently obtained in three

cases of prostatic abscess with the curvilinear prerectal incision without opening the urethra seem to warrant the presentation to you of a brief report.

CASE I.—G. W., aged twenty-four years, was admitted to the Jewish Hospital, January 30, 1902. Family history negative. Had an attack of typhoid fever six years ago. Gonorrhœa, eight months ago. During three or four years has had symptoms of gall-stone colic. The attacks, coming every three or four months, were occasionally followed by jaundice. Has been confined to a London hospital for like attack. Present illness has lasted one week.

Present Condition.—Well-nourished young man, chief complaint, pain in the region of the gall-bladder, over which there is a marked tenderness. Temperature on admission, 102-112° F.; pulse, 110. Physical examination shows great tenderness over the gall-bladder without either enlargement of gall-bladder or liver. Tongue coated, bowels rather constipated. From day of admission, the temperature gradually subsided until from the fifth day after admission to the tenth day it remained normal. On this day there was again an elevation to 102°, which subsided by the thirteenth day, when it was again normal. Diagnosis, cholecystitis, probably of calculous origin.

Operation, February 11, 1902, cholecystotomy. Gall-bladder found considerably thickened and slightly enlarged, but very adherent to omentum, colic arch, and pylorus. These adhesion were readily severed. The incision into the gall-bladder gave vent to a turbid, ropy bile, containing biliary sand in considerable quantity. Gall-stones were not found. The biliary ways were patent. Drainage of gall-bladder. From the day of the operation, the patient's temperature returned to the normal, and remained so until February 18, when there again was a rise to 102°; from this time to the 23d it again remained about normal; when it rose to 103°. It then fell rapidly and continued about normal until March 4. Five days after the cholecystotomy, there appeared a profuse purulent urethral discharge, the examination of which showed an abundance of Neisser diplococcus. Within four days of its presence the patient complained of intense pain in the perineum and rectum and of frequency of micturition. Examination at this time showed a considerably enlarged and exquisitely ten-

der prostate. Hot baths, opium, and belladonna were ordered as required. Notwithstanding the continuance of a normal temperature and normal pulse-rate, the local symptoms increased in severity. Rectal touch revealed fluctuation indistinctly. Diagnosis, prostatic abscess.

Second operation, March 4, 1902. Prerectal curvilinear incision beginning near the tuber ischii of the right side curving around and within an inch of the anal orifice to the same point on the left side. A staff was not used. After the division of the superficial fascia with a few fibres from the external sphincter to the bulbocavernosus, the bulb of the corpus spongiosum and the transverse perineal muscles were readily exposed and drawn forward with a blunt retractor. The rectum was then drawn backward, and in the depth of the wound the fibres of the levator ani and the compressor urethræ were held aside after blunt dissection. By this blunt and almost bloodless dissection the rectum was easily separated from the posterior surface of the prostate gland. The urethra was not opened. With an aspirating needle the abscess within the gland was easily located. It was opened through a median posterior incision. Vent was thus given to about one ounce of thick creamy pus. The examination of this later showed the Neisser diplococcus and the staphylococcus. A small drainage tube was inserted into the abscess cavity, and the large wound, which had somewhat the appearance of the vagina, was readily closed by three silkworm-gut sutures on each side of the middle line. The hæmorrhage during the operation was almost *nil.*

Subsequent History.—From the day of operation, there was not again any elevation of temperature. The discharge decreased rapidly. The patient left the hospital, April 1, entirely well.

Case II.—F. A., age thirty, admitted to Good Samaritan Hospital, March 3, 1902. Referred by Dr. Garlick. First attack of gonorrhœa eight weeks ago. Discharge lasted four weeks and ceased two weeks before he came under physician's observation. With cessation of discharge, the patient noticed a sense of weight in the perineum and pain on defecation. Referred most of his symptoms to the rectum. Symptoms on the part of the bladder and the urethra had been negative since cessation of discharge. Has had neither chill nor elevation of temperature.

Present Condition. — Well-nourished male, short stature, weighing 180 pounds. Complains only of pain in rectum and of tenesmus. Frequency of micturition, temperature, and pulse normal. Blood count shows 6800 leucocytes. Urinalysis. Urine slightly turbid, due to presence of pus cells, otherwise normal. Rectal touch reveals an exquisitely sensitive prostate, considerably enlarged and tense to elasticity. Rectal wall easily movable over posterior surface. Diagnosis, small prostatic abscess.

Operation, Good Samaritan Hospital, March 14, morphia, chloroform narcosis. The operation was made as in the previous case. The exploratory needle revealed a deep-seated abscess, which was evacuated by a small median incision through the posterior wall. The opening was enlarged by the Hilton method. Not to exceed a tablespoonful of pus was evacuated. Culture revealed only the staphylococcus. Drainage as in the previous case was provided for, and the wound was closed.

Subsequent History.—Except for the occasional and slight escape of gas from the drainage tube, from the fourth to the eighth day the recovery was uneventful. The dissection having been made close to the rectal walls, it is probable that a limited necrosis ensued. An examination of the rectum seemed uncalled for, and was not made. The patient left the hospital eighteen days after the operation, entirely recovered. He presented himself for examination, April 29, stating that he had resumed his work for the past three weeks and felt entirely well. There was no recurrence of the urethral discharge.

CASE III.—F. B., aged thirty-three years, single, hostler, entered City Hospital May 17, 1902. Had gonorrhœa five or six times. Stated that six weeks ago there developed a new case. It ran its usual course until two weeks ago, when he noticed great pain about the scrotum and great pain in defecation and in the scrotum at that time.

The temperature ranged from 100.5 to 101° F. At his admission was 101°.

Physical Examination.—A well-developed male, weighing nearly 200 pounds. Normal except for urinating symptoms. Patient is unable to urinate without use of the catheter. Examination of the prostate through the rectum shows it to be very tender and slightly enlarged. Operation, May 19. Prerectal

curvilinear incision as in the cases above reported. Abscess located with aspirating needle and opened by median incision. Hæmorrhage very slight. Drainage tube and iodoform-gauze packing.

Subsequent History.—From time of operation, patient's temperature went to the normal. Control of the bladder with normal expulsion of the urine was regained the day following the operation. May 30 the wound has almost healed, the patient is about ready to leave the hospital.

One valid but slight objection has been urged to the prerectal incision. It was encountered in the second case. I refer to the sloughing of the anterior wall followed by a fistula. I imagine that when large prostates are removed, this danger would be somewhat greater. By adhering closely to the prostatic capsule and guiding the cleavage away from the rectum, this danger will be minimized. The advantages of this method of operation fully outweigh this possible, though not probable, wound complication. The difficulty of bringing the prostate into the perineal wound has been extensively considered and various methods devised for this end. Among these might be cited preliminary suprapubic cystotomy or opening of the prevesical space through which the prostate can be pushed towards the perineal wound. Syms [6] has recently devised a rubber bag to be introduced into the bladder through a boutonniére, then to be filled with water and used for drawing the prostate into the wound. I have found none of these devices necessary in reaching the prostate, and believe that the same can be accomplished by the use of a short-beaked stone searcher, which by being firmly depressed can be made to bring the prostate within easy access for any manipulation that might be needed. In prostatic hypertrophy, when a major operation is indicated and the opening of the urethra is not essential, the method of reaching the gland as above indicated will, I think, give the best results.

The first case presented is of interest from the view-point

of diagnosis. In the absence of the finding of the prostatic abscess by the second operation, the conditions found at first would have been deemed sufficient to explain the symptoms. Two years before this operation, the diagnosis of cholecystitis had been made in a London hospital; although no acute inflammatory conditions were found in the gall-bladder or biliary ways, it still seems probable that the prostatic abscess developed during the convalescence from the first operation. The salient features of the second case were the predominance of the rectal symptoms and the absence of all signs pointing to a serious involvement of the prostate. In both cases there was conspicuous by its absence the complex of symptoms usually associated with prostatic as with other deep-seated abscesses, namely, rigor, pyrexia, and rapid pulse-rate. The interpretation of this might be found in the fact that the suppuration was inclosed within the tight capsule of the gland, which made absorption difficult. It is with the invasion of the loose periprostatic connective tissue by the suppuration that the systemic symptoms develop, much as they do in the periadenitis following the mixed infections of the cervical glands.

If we exclude as thoroughly uncommendable the rectal methods of incising prostatic abscesses, there remain only for our consideration the various perineal incisions, of which I may be permitted to make a brief comparison. The median incision must always hold a prominent place for the quick exploration of the deep urethra, prostate, and bladder, but the field of its usefulness wil grow more and more restricted with the betterment of diagnostic methods and the substitution of the crushing for the cutting operation for stone. Its chief merit is in its relative bloodlessness. This advantage is, however, largely lost in prostatic subjects because of the difficulty of avoiding the bulb, which is often enlarged, and because of the difficulty of hæmostasis, when hæmorrhage does occur. The limited field of operation makes the sense of touch rather than that of sight the guide of operative manipulation. This is one of its faults. The opening of the membranous urethra, a *sine qua non* of the

median operation, is another and very serious one. However desirable this may be when bladder drainage is demanded, it subjects the patient often to the inconvenience of temporarily losing control of the bladder, and unfortunately often leaves an embarrassing urethral fistula. I have seen this in a number of cases of gonorrhœal and of tubercular abscess operated upon in this way. On the other hand, the prerectal incision as before described does away with this danger altogether. It allows a free inspection of the field of operation, such as can be obtained by no other method. Hæmostasis, not very difficult, can be done in plain sight, and, unless special indications exist for opening the urethra, this can be absolutely avoided as in the cases above reported. In subjects with enlarged or inflamed prostates the submucous plexus of veins is turgid. Those familiar with suprapubic prostatectomy know the severe bleeding which immediately follows the incision of the mucosa. In the operation of prostatectomy by median incision, the hæmorrhage is as free, but its source is not patent. By avoiding the opening of the urethra wherever possible, this grave element of danager is largely eliminated. In the judgment of the writer, it was a retrograde step when operators receded from the original idea of Dittel, not to open the urethra in perineal prostatectomy. The ease with which everything in front of the incision—bulb, transverse perineal muscles, and even membranous urethra—can be drawn forward reduces to a minimum the danger of hæmorrhage. The division of the superficial perineal vessels occurs in an open wound, where they can easily be seen and tied.

Various modifications of the prerectal operation have been made, all making far greater room for operative work. In the operation for prostatic abscess, the prerectal incision alone will suffice. For the major operation of prostatectomy, an incision made from the right extremity of the initial cut into the ischiorectal fossa and carried around the right side of the anus towards the coccyx affords an abundance of room for the thorough isolation of the prostate before its removal is com-

menced. This operation, devised by Gosset and Proust,[7] permits the operator to displace the rectum backward and to the left. I have not had an opportunity of doing the operation on the living, but on the cadaver. It has seemed to me ideal.

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A CONTRIBUTION TO THE SURGICAL ANATOMY OF THE MIDDLE CRANIAL FOSSA,

WITH SPECIAL REFERENCE TO OPERATIONS FOR THE REMOVAL OF THE GASSERIAN GANGLION.[1]

(From the Anatomical Laboratory of Washington University.)

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My limited experience, gained by removing the Gasserian ganglion but three times, has been sufficient to show that we require, for the accurate performance of this procedure, more exact knowledge of the middle meningeal artery and the floor of the middle cranial fossa than is contained in text-books on anatomy. At the first operation the artery was seen coursing across the field after the bone opening had been made as advised by Cushing;[1] in the second case the technique employed was the same; still, this vessel was seen at no time; while in the third, I cut with the first stroke of the chisel a middle meningeal which lay in an unusually deep groove. That it is desirable to avoid such an accident, all who have ever experienced or seen it will agree with me. Still, none of the forty works on anatomy which I have examined give us much help in this matter by even mentioning this as being a very irregular artery, or by furnishing us with the usual dimensions of the parts which engage our attention; hence I have photographed a number of unusual middle meningeal grooves, as well as made careful measurements on the floors of 100 fossæ, in the hope that the averages thus obtained might be of use in simplifying a surgical procedure which is generaly regarded as very difficult.

[1] Read before the St. Louis Medical Society on February 1, 1902.

The operations to which I have referred were done October 10, 1900; November 28, 1900, and September 24, 1901. The first two were reported in the ANNALS OF SURGERY of June, 1901, while the third is as yet unpublished; all three resulted favorably, although section of the middle meningeal artery came very near costing the third patient her life.

I am indebted to Professor Terry, of Washington University, for having placed at my disposal the skulls of the museum at the medical school, as well as those which are used for teaching purposes in his department. I regret that I could not see these heads before dissection; still, the specimens chosen from this material are presumably all of the adult type, and certainly in great part belong to male skeletons, as will be readily appreciated by those who are familiar with our dissecting-rooms, whence these bones are derived. In this series no attention is paid to the cause of death or to the nationality of the individual skull's former owner. I am well aware that the dimensions of the skull vary in the different races, and with various morbid conditions, hence have, for this very reason, sought to subserve the interests of practical surgery by disregarding the fact and furnishing working averages.

The character of the floor of the middle cranial fossa is a matter of decided interest to the operator who would attack the ganglion by the temporal route, the one now most in vogue, since, from this bony field, the dura mater must be stripped before the second and third branches can be seen or reached. Every one who has done the operation a few times must have noted that it is often difficult, or even impossible, to approach the foramen rotundum or ovale until certain bony inequalities have been chiselled away. This had been my experience in two of the three cases above referred to; still, I was hardly able to appreciate the endless variety of ridges and eminences which render this surface irregular, until I had examined a large number of skulls. In fact, one can say, with justice to the truth, that the interiors of a number of skulls are no more alike in appearance than are the exteriors of the soft structures which clothe and adorn them. Inter-

esting in this particular are the conclusions recently made by Dr. Amyx,[2] of this city, in his "Observations and Remarks on Removal of the Gasserian Ganglion in the Cadaver." In one of the specimens examined by me the conditions for operation would have been particularly annoying; here there was a well-defined and sharply cut cavity for the reception of the ganglion and its branches, and of such depth that a ganglion of the usual dimensions must have lain with its upper surface flush with the bony floor of the middle fossa.

The anatomists give us no inkling of the fact that the foramen rotundum is not always round and that the foramen ovale is by no means always oval; nevertheless, such is the case. I must say, however, that the foramen ovale is much less regular in shape and size than its smaller mate. It was seen in 100 instances to assume every form between a long, narrow slit and a perfectly round opening, so was in many cases far from the "oval or half-oval" of v. Bardeleben[3] with its cross-axis of 5.8 millimetres. One might supppose, from studying the various works on anatomy, that the foramina rotundum, ovale, and spinosum were constant as regards the directions in which they transmit respectively the second trigeminus branch, the third trigeminus branch, and the middle meningeal artery through the floor of the skull. This is far from the truth, however; the directions of their courses vary greatly in the different individuals.

The bone opening as made by Cushing in approaching the ganglion has for its lower margin the infratemporal crest, a ridge in which too much dependence is not to be placed, since it is demonstrated by my series to be inconstant. In two instances there was absolutely no sign of any such structure, while in a number of others it was so faint as to have made detection of it during a surgical operation highly problematic, if not altogether impossible. It is, however, a useful landmark when present, and represents the point at which the operator must begin to strip the dura mater from the osseous floor, proceeding towards the ganglion a distance which is measured on the outside of the skull by the space

which intervenes between the crest and the foramen rotundum or ovale. Now, it may save an operator some embarrassment, especially if the case be his first, to know the average width of the middle cranial floor between the points mentioned, or, in other words, to know how far he will have to elevate the dura mater before he can attack the envelopes of the ganglion at one of these two points of least resistance.

Of the two foramina, the ovale is far the more accessible on the exterior of the cranium; so I measured the distance between this opening and the infratemporal crest at a point when the latter is crossed by the sphenotemporal suture and found as follows:

DISTANCES BETWEEN FORAMEN OVALE AND INFRATEMPORAL CREST.

17	millimetres in 3 cases.	22.5	millimetres in 4 cases.
18	millimetres in 7 cases.	23	millimetres in 7 cases.
18.5	millimetres in 2 cases.	23.5	millimetres in 1 case.
19	millimetres in 10 cases.	24	millimetres in 4 cases.
19.5	millimetres in 1 case.	24.5	millimetres in 2 cases.
20	millimetres in 11 cases.	25	millimetres in 4 cases.
20.5	millimetres in 5 cases.	25.5	millimetres in 1 case.
21	millimetres in 14 cases.	26	millimetres in 3 cases.
21.5	millimetres in 6 cases.	27	millimetres in 3 cases.
22	millimetres in 8 cases.	30	millimetres in 2 cases.

Thus from these figures is deduced as an average 21.5 millimetres, the distance which the surgeon must traverse over the floor of the middle cranial fossa before he can reach the point of exit of the third branch of the trifacial at the foramen ovale. It is, however, customary to attack the envelopes of the ganglion at the foramen rotundum, and the figures above quoted answer about equally well for it as for the foramen ovale, the two openings being almost equally distant from the infratemporal crest at the point where it is crossed by the sphenotemporal suture.

Having the above, it is none the less necessary that we, as surgeons, know the average anteroposterior dimension of our field of operation, represented by the distance between the anterior border of the foramen rotundum and the posterior

border of the foramen ovale. It is, indeed, surprising to note how little aid is to be derived, in this particular, from books on anatomy. The text-book writers of the last 164 years, as far as their works are at my command, have favored us with but meagre details as regards the average distances between the various points on the floor of the skull. The exact amount of bone which separates the foramina rotundum, ovale, and spinosum is entirely ignored by Keill[4] and Cloquet,[5] while Wistar[6] merely mentions that the ovale is half an inch behind the rotundum. Meckel[7] writes nothing of distances, but Horner[8] informs us that the ovale is eight lines behind the rotundum, while the spinosum is still two lines farther back. That is all, however, for one must look in vain after any records of measurements in the works of Horner[9] (special anatomy), Masse,[10] Smith,[11] Arnold,[12] Wilson,[13] Bock,[14] Quain,[15] Richardson,[16] Jamain,[17] Dursy,[18] Hyrtl,[19] Sappey,[20] Henle,[21] Ward,[22] Pansch,[23] Allen,[24] Merkel,[25] Weisse,[26] Holden,[27] Hyrtl,[28] Heitzmann,[29] Heitzmann[30] (a later work), Thane,[31] McClellan,[32] Gray,[33] Holden,[34] Gegenbauer,[35] Spalterholz,[36] Tillaux,[37] Deaver,[38] Gerrish,[39] v. Bardeleben,[40] Morris,[41] Hermann,[42] Morton,[43] or Bonamy and Broca.[44]

Nevertheless, the surgeon who is acquainted with the average dimensions of his field of endeavor is manifestly better equipped than he who possesses no such data, hence I have tried to supply what is desirable in regard to the average distance from the anterior border of the foramen rotundum to the posterior border of the foramen ovale.

In 100 instances this anteroposterior measurement was found to vary from 16 millimetres to 27 millimetres, and this in skulls whose dimensions showed very little difference in other respects. No one can doubt that it is a matter of some importance to the surgeon to know that one of the important distances with which he has to deal may be almost twice as great in one head as it is in another of the same size; especially as this can be discovered in the individual instance only after he has arrived at the bottom of a deep operative well, in which the powers of vision are limited at best.

DISTANCES BETWEEN FORAMEN ROTUNDUM AND FORAMEN OVALE.

16	millimetres in 1 case.	21	millimetres in 12 cases.
16.5	millimetres in 1 case.	21.5	millimetres in 6 cases.
17	millimetres in 3 cases.	22	millimetres in 15 cases.
17.5	millimetres in 5 cases.	22.5	millimetres in 1 case.
18	millimetres in 8 cases.	23	millimetres in 3 cases.
18.5	millimetres in 7 cases.	23.5	millimetres in 1 case.
19	millimetres in 12 cases.	24	millimetres in 7 cases.
19.5	millimetres in 1 case.	24.5	millimetres in 1 case.
20	millimetres in 9 cases.	25	millimetres in 2 cases.
20.5	millimetres in 4 cases.	27	millimetres in 1 case.

Thus the average distance was found to be 20.4 millimetres, which can be said to be the length of the slit one may expect to make in the envelopes of the ganglion, in order that its body may be freed together with the second and third branches. Through this same size opening the first branch can be dissected, likewise the sensory root, if a curved spatula be used.

Even more important than the foregoing is exact knowledge of the usual distance between the foramina ovale and spinosum, since through the latter passes the middle meningeal artery, and through the former the third branch of the trigeminus; two structures which must be cleanly separated before the ganglion can be removed in its entirety. Certain surgeons, among them Lexer,[45] Murphy,[46] and Friedrich,[47] have torn off the artery at this point without any very serious result; still, in general, it must be said that the accident is one of the most unfortunate which can complicate the operation, usually bringing the same to an untimely close, and greatly endangering the life of the patient. It is, then, in view of all this, very important for us to know that the relation between the two foramina, and hence between the nerve and artery, is exceedingly variable, a point which Dollinger[48] demonstrated quite recently.

In one of the middle fossæ which I measured, there was no foramen spinosum at all, the artery coming into the cranial cavity, as its groove indicated, through the foramen ovale alongside of the third branch of the fifth nerve; had this sub-

ject been operated upon, the artery could hardly have escaped injury. Knowledge of such a possibility is, however, none the less desirable, for he alone who is forewarned can be forearmed. The other extreme is illustrated by another of my skulls in which the opening for the entrance of the middle meningeal was situated a distance of 18 millimetres from the foramen ovale. It is scarcely possible to conceive of the artery being encountered under these circumstances.

Between these two extremes were found the greatest variety of conditions existing in the different skulls,—some of them would, as will be seen from the table below, have favored an easy operation, while others must have tended to render the same very difficult.

DISTANCES BETWEEN FORAMEN OVALE AND FORAMEN SPINOSUM.

0.5 millimetre	in 4 cases.	4 millimetres	in 14 cases.
1 millimetre	in 6 cases.	5 millimetres	in 8 cases.
1.5 millimetres	in 5 cases.	5.5 millimetres	in 3 cases.
2 millimetres	in 23 cases.	6 millimetres	in 1 case.
2.5 millimetres	in 13 cases.	7.5 millimetres	in 1 case.
3 millimetres	in 14 cases.	18 millimetres	in 1 case.
3.5 millimetres	in 6 cases.		

Thus it is seen from these figures that an average distance of 3 millimetres separates the openings through which pass the middle meningeal artery and the third branch of the trigeminus, a space in which the operator has, with careful work, sufficient room for the manœuvres required for the dissection of the posterior surface of the third branch, without exposing the vessel to danger.

Dollinger [49] found that even when sufficient bone separated the two openings just considered, the posterior border of the spinosum lay in front of the anterior border of the ovale in 6 per cent. of his cases, and thus the artery rendered the third branch inaccessible from the Krause [50] bone opening by being directly between the two. He therefore concludes that the operation is possible of accomplishment in 6 per cent. of cases only after the external carotid (from which the middle meningeal is derived) has been ligated; a procedure

which Davis,[51] Spellissy,[52] and others have warmly advocated. Should the middle meningeal so placed be discovered before it had been torn, it might, it seems to me, be possible still to dissect out the ganglion without tying the carotid, by working in front of and to the inner side of the vessel with a curved spatula or elevator. The plan were worth a trial, at any rate.

In comparing the two sides of the skulls examined by me, a marked asymmetry was noted. Thirty-four of the middle fossæ under consideration belonged to seventeen skulls which had not been sawn through the median line, so I was easily able to make direct comparison, in them, of the three dimensions now under consideration. The distance from the infratemporal crest to the foramen ovale on the right side averaged 20.5 millimetres, that on the left averaged 20.9 millimetres. The average space which intervened between the anterior border of the foramen rotundum and the posterior border of the foramen ovale on the right side was 21.2 millimetres, on the left, 20.5 millimetres. The bony partition separating the foramina ovale and spinosum measured, on an average, right, 3.38 millimetres, left, 2.80 millimetres; giving us the two first-named dimensions greater on the left side, and the last named considerably larger on the right. I mention this matter only for what it may be worth; the number, seventeen, is, of course, far too small to furnish us with reliable working averages.

It will be noticed from the above that the distance between ovale and spinosum is greater on the right side, where that between rotundum and ovale is shorter; an observation which struck me so forcibly, while determining these measurements on the same side, in single instances, that I determined to institute a comparison of the extremes of all these dimensions in order to see if practical surgical deductions might not be drawn therefrom. It was found that the average of the fifty smallest spaces separating rotundum and ovale was 18.6 millimetres, while the average of the spaces between ovale and spinosum in the same fossæ was 2.9 millimetres. However, the fifty fossæ which gave the largest space between rotundum

and ovale, averaging 22.3 millimetres, showed an average of but 3.1 millimetres between ovale and spinosum; this being, contrary to what one might expect, a *relatively* shorter distance between ovale and spinosum in those cases which give the longer distance between rotundum and ovale. The following mathematical calculation demonstrates the truth of my statement,—18.6 : 2.09 :: 22.3 : x (x equals 3.5); hence the distance between ovale and spinosum would have to average at least 3.5 instead of 3.1, as I found it, if it were relatively as great in those cases which have the longer dimension between rotundum and ovale as it is in those having the shorter. The matter is certainly one of striking interest; and it must be of surgical importance to know that in 100 fossæ the closer the third trigeminus branch was to the second the farther the third and middle meningeal arteries were apart, and *vice versa*. This tendency becomes much more apparent when a smaller number of extreme cases are compared. Take, for example, our fourteen fossæ which show the shortest distance between the ovale and spinosum, having an average of but .89 millimetre, less than one-third the normal for the whole 100; these same give an average measurement of 20.3 millimetres between their rotundum and ovale; a surprisingly large figure when we consider that it is but one-tenth of a millimetre short of the average obtained for this dimension in all the skulls examined. On the other hand, the fourteen which averaged the highest between ovale and spinosum, viz., 6.32 millimetres (normal, 3.0), furnished an average of but 19.5 millimetres from rotundum to ovale, smaller, even, than that of the skulls whose ovale and spinosum were closest together. Thus in the one set of cases the relation between the rotundum-ovale and the ovale-spinosum dimensions was represented by 3.1 to 1, and in the other by 22.7 to 1; a marked difference in supposedly normal skulls, to say the least.

It is vastly more important to the surgeon, however, to study the matter in a way which is the reverse to that which has just been given; for he will, so to speak, have given the rotundum-ovale dimension, while that from ovale to spinosum

must be determined and is of vital importance, as upon it depends whether or not the third branch, together with the intact ganglion, can be removed without the vessel being torn. It may be argued that the operator should see the artery at the point where it penetrates the floor of the middle fossa, and thus be in a position to protect it. This can only be answered by saying that such a desirable possibility exists in those rare cases where venous hæmorrhage is slight during the whole operation, and in no others. In one of my three operations I had passing glimpses of the artery now and then, while in the other two I never saw the portion of it which is now under discussion. Taking 20.4 millimetres as the normal distance from the foramen rotundum to the foramen ovale and 3.0 millimetres as that from the ovale to the spinosum, I was surprised to ascertain that my fifteen middle fossæ which presented the shortest space between rotundum and ovale, averaging but 17.4 millimetres, gave the relatively high average distance of 3.6 millimetres between ovale and rotundum; the two measurements being in the ratio of 4.78 to 1. On the other hand, the fifteen fossæ which showed the highest average distance between rotundum and ovale, viz., 24.1 millimetres, measured on the average but 2.4 millimetres from ovale to spinosum, dimensions which are in the ratio of 9.79 to 1.

These measurements, when considered thus from various stand-points, seem to me sufficient warrant for the assertion that the operator may expect to find the middle meningeal artery, at the point where it pierces the floor of the middle temporal fossa, farthest from the third branch of the trigeminus, in just those cases which show the first and second branches to be nearest together. Under such circumstances, injury to the artery at this point is scarcely to be feared; but the surgeon must be exceedingly wary in the further development of a case in which he has found the first and second trigeminal branches far apart, for it is in such a cranium that he may expect to find the vessel very close to the third branch.

This artery again becomes an object of decided interest to us in that part of its course which is commonly supposed

to cross the bony opening in the temporal fossa, through which we aim to reach the ganglion; reference is made here to the bone wound suggested by Cushing, it being a little lower as well as smaller than that of Krause. But before the middle meningeal has run so far, it has usually divided once at least; concerning this point of primary division, however, one gains conflicting opinions from the various writers on anatomy. Meckel [53] calls the vessel the " sphenospinal," and remarks that it may divide before it has entered the skull at all, while Wilson,[54] Dursy,[55] and Tillaux [56] seem to be of the opinion that the bifurcation is situated just within the cranial cavity, that is very near the inner terminus of the foramen spinosum. On the other side, Quain,[57] Sappey,[58] McClellan,[59] Spalterholz,[60] Gerrish,[61] and Morris [62] aver that some distance across the floor of the middle fossa is traversed before any division occurs; but Merkel [63] writes that the artery is irregular in this respect, as it may divide at any point in its course. My own observations would go to prove that the last named author alone is correct in his statement, though none of the others are wholly wrong, for in the 100 half-skulls under discussion at least one can be shown in proof of the assertion of every anatomist mentioned.

Not alone is the point of primary division of the middle meningeal irregular, but the farther course of the vessel as well is exceedingly varied in the different skulls; indeed, I was so often impressed by this fact while studying the fossæ in question, that I felt constrained to have photographed eleven specimens which well serve to illustrate the point.

One point of interest to the surgeon, which has been mentioned by Cloquet,[64] is that this vessel, or a part of it, may lie in an actual bony canal instead of in a groove. Division of the continuity of a bone bearing such a canal necessarily involves the operator in a most undesirable predicament; hence the value of knowing that any skull may present such an anomaly. It was encountered but once in the skull-half with which we are engaged. In that one the groove became a closed canal at a point 4.5 centimetres from the foramen spinosum, and

FIG. 1.—The middle meningeal artery, in this case, divides at the internal opening of the foramen spinosum, the anterior branch taking a course internal to the sphenotemporal suture, while the posterior runs outward and backward.

FIG. 2.—Presents a middle meningeal which runs outward and slightly forward a certain distance before it divides. Then the anterior branch takes its course external to the sphenotemporal suture, while the posterior runs outward and slightly backward.

FIG. 3.—The vessel here runs a still greater distance directly outward from the foramen spinosum before dividing. The anterior branch then runs almost directly forward, outside the sphenotemporal suture, and the posterior continues for a time in the direct outward course of the parent trunk.

FIG. 4.—The artery, in this instance, leaves the foramen spinosum in an outward and backward direction; then, after proceeding a little farther than any of its predecessors, divides into two branches. The anterior runs forward and somewhat outward, well external to the sphenotemporal suture; the posterior, however, continues the outward and backward direction assumed by the main trunk.

FIG. 5.—This vessel is the last of its general type. It differs from No. 4 only in that it runs farther from the foramen spinosum before branching.

FIG. 6.—This specimen is peculiar from the fact that it does not branch at all on the floor of the middle fossa. From the time it emerges from the foramen spinosum, it continues in a forward and outward course, lying meanwhile well external to the sphenotemporal suture.

FIG. 7.—The middle meningeal, in this instance, presents a most unusual aspect,—it does not divide on the floor of the fossa; and, furthermore, the vessel, after emerging from a foramen spinosum which is very close to the foramen ovale, takes a course outward and *backward*.

FIG. 8.—The artery is here more complicated in its distribution. Leaving the foramen spinosum, it runs directly forward, but, before proceeding any distance, gives off the branch which usually runs backward and outward. After reaching a point a little in advance of the foramen ovale, it again divides, the external branch running forward and outward, while the internal keeps right on in its anomalous course past the foramen rotundum. One can easily imagine how this last-named branch could have worried the surgeon; having passed the external branch at about the point where we have usually seen the single anterior branch, he would naturally not have expected to find or injure another artery before reaching the foramina.

FIG. 9.--This represents another subject which must have been difficult for the surgeon. Just as it leaves the foramen spinosum, the middle meningeal gives off a branch which takes a course forward and inward past the foramina rotundum and ovale; the main trunk continues outward and slightly backward from the foramen spinosum for a considerable distance, to divide into an anterior and a posterior branch.

FIG. 10.—An operation would here have been easy as far as the middle meningeal is concerned. Almost two centimetres (exactly eighteen millimetres, or nearly one inch) separate the ovale and spinosum —or at least the opening through which the artery passes. The vessel could hardly have been injured in the dissection of the third branch of the trigeminus.

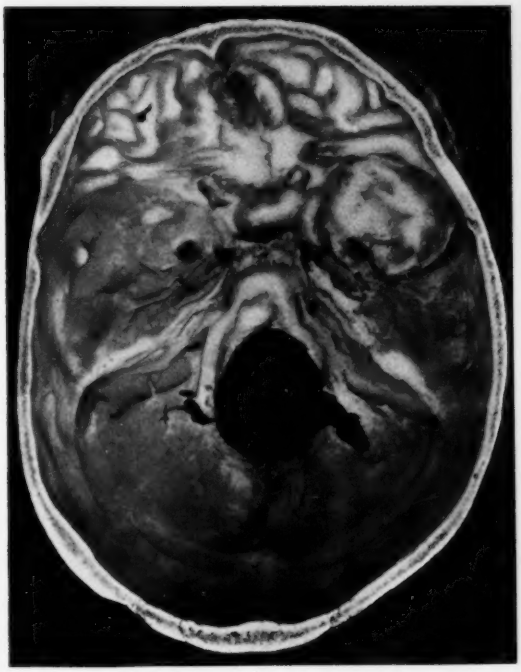

FIG. 11.—Just the opposite condition is here depicted. The middle meningeal could, in this instance, hardly have escaped injury at the point where it enters the skull. It must have been torn at the removal of the third trigeminus branch; for, as the photograph shows, there is an absence of the foramen spinosum,—the artery emerging from the foramen ovale and taking first a course backward, then one outward, and, lastly, one slightly forward.

continued as such over a space within which lies the superior margin of the Cushing bone opening; hence it is clear that this case must have proven a troublesome one for the operation which bears that surgeon's name.

Of no less surgical interest is the condition described by v. Bardeleben [65] in which part of the middle meningeal groove is represented by an actual defect in the bones of the cranial floor; under such circumstances, the vessel would, as a matter of course, be especially exposed to traumata from without. No such anomaly presented itself in my series of skulls; still, I noted in a number of thin-walled specimens that the floor of the groove was apparently no thicker than paper and readily transmitted the light.

Another startling irregularity in the course of this vessel, and one which I have seen mentioned nowhere else, was observed by Dr. Carson,[66] of our city. Here the artery actually left the cranial cavity by a foramen, and, appearing on the outer surface of the skull in the temporal region, was naturally enough torn or cut during the operation.

Supposing, however, the middle meningeal to have escaped injury, there are, besides the venous channels, other sources of hæmorrhage which may prove very serious, unusual vessels with which the surgeon cannot reckon in advance; for instance, the large branches of the internal maxillary artery, which Quain [67] saw enter the cranial cavity through the foramena rotundum and ovale, in a case where there was congenital absence of the internal carotid. It may well serve to make one more careful, in advising or attempting removal of the Gasserian ganglion, to be informed of all these possible conditions.

It is perplexing to note, before leaving the middle meningeal, the various functions which the authors have ascribed to it. Quite a number refer to it in such a way that one might be led to think of it as supplying the dura mater alone. Wilson [68] writes that it furnishes blood to the *bones* of the cranium, while Hyrtl [69] and Heitzmann [70] undoubtedly regard the matter in its true light when they tell us that it is the feeder of certain bones as well as a part of the dura.

It had been my hope, in undertaking this subject, to be able to formulate some rule for avoiding this artery in making the bone opening necessary to a removal of the Gasserian ganglion. This is, however, manifestly impossible in dealing with a structure which is so irregular that in 100 middle fossæ it can hardly be said to follow identically the same course in any two. Not possessing an ideal routine, it is then next in importance that we realize the possibility of meeting the artery at almost any point in the temporal fossa,—it may be lying upon the inner surface of the bone, embedded within the same, or, in rare instances, outside the protecting wall.

In determining the various average dimensions of the field of operation, in depicting certain anomalies of the middle meningeal artery, and in calling attention to the fact that this vessel is most easily avoided at the point where it enters the cranial cavity, in those cases which have the second and third branches of the trifacial closest together, something has, I trust, been done towards perfecting and rendering more safe the difficult procedure which offers victims of trigeminus neuralgia their only hope of permanent relief.

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THE "CIRCULUS VITIOSUS" FOLLOWING GASTRO-ENTEROSTOMY,

WITH A DESCRIPTION OF A NEW OPERATION DESIGNED TO PREVENT ITS OCCURRENCE.[1]

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THE occurrence of vomiting following gastro-enterostomy is always a source of anxiety to the surgeon, for it suggests to him the advent of that most unfortunate condition known as "the vicious circle." The indiscriminate use of the latter term, however, is to be deprecated, since, though vicious it may be, the "circle" is not always present. The term regurgitation, or, better still, reflux, is much to be preferred in indicating the passage of bile and pancreatic secretion, as well as that of the contents of the jejunum, into the stomach. The term "vicious circle," if employed at all, should be restricted to those cases in which the stomach contents pass into the afferent or duodenal side of the loop of intestine forming the gastro-enterostomy, and are subsequently returned to the stomach mixed with the secretions from the duodenum, these including bile and pancreatic juice. In the remaining cases, namely, first, those in which the secretions alone pass from the afferent limb of the loop backward through the still more or less permeable pylorus, as, for instance, in those cases in which the operation is performed for non-carcinomatous stenosis, gastroptosis, and dilatation of the stomach, the last named

[1] Read by title at the Twenty-third Annual Meeting of the American Surgical Association, Albany, New York, June 3, 4, and 5, 1902.

two of which, according to Yersin, depend upon marked alterations of the pylorus; second, those in which the bile and pancreatic juice pass through the afferent portion of the loop; and third, cases in which the jejunal contents are forced into the stomach through retroperistaltic movements in the efferent portion of the loop or by means of mechanical pressure during acts of vomiting; in all of these the term "reflux" is more applicable.

An essential feature of the original operation of gastro-enterostomy as applied by Billroth in connection with resection of the pylorus (Fig. 1), as well as in that of Wölfler's first method, is the passage of the contents of the duodenum into the stomach from the afferent loop, thence, mingled with the stomach contents, passing into the efferent portion of the loop. It is likewise an essential feature of Von Hacker's posterior gastro-enterostomy (Fig. 2). Wölfler, realizing that no dependence could be placed upon the invariable passage of the gastric contents into the efferent portion of the loop, and in order to prevent the occurrence of the vicious circle, divided the jejunum and implanted the end of the efferent portion into the previously incised stomach wall, and the end of the afferent portion into the efferent portion (Fig. 3).

Luecke, in attempting to overcome the evils arising from retroperistaltic jejunal reflux, proposed to so arrange the loop of intestine employed for the gastro-enterostomy as to secure peristalsis on the part of the stomach and of the efferent portion of the loop in the same direction. This necessitated crossing the two legs of the loop (Fig. 4), itself a dangerous procedure as shown by McGraw.[1] In this operation of Luecke's no provision is made for preventing duodenal reflux, an omission of comparatively slight importance so long as the contents of the duodenum find their way out of the stomach again with readiness, since the passage of bile and pancreatic secretion from the duodenum into the stomach without doubt takes place under circumstances of absence of disease of the latter, without serious inconvenience, as, for instance, during attacks of nausea and vomiting, these being either promptly vomited or returned

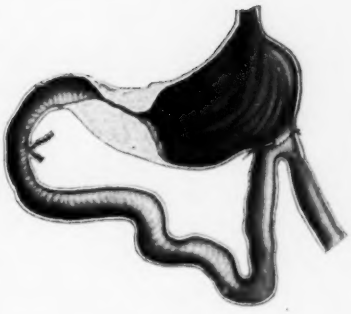

FIG. 1.—Billroth's original operation of gastro-enterostomy.

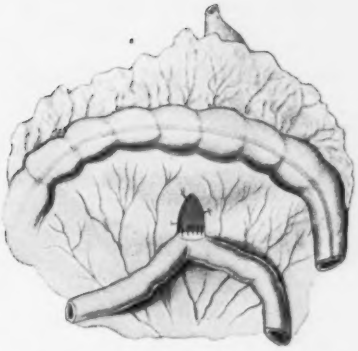

FIG. 2.—Von Hacker's posterior gastro-enterostomy.

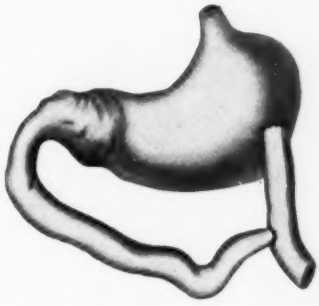

FIG. 3.—Wölfler's method of gastro-enterostomy.

FIG. 4.—Luecke's operation of gastro-enterostomy.

to the duodenum. Under conditions of gastro-enterostomy for pyloric carcinoma, however, the obstruction at the pylorus prevents return to the duodenum by the usual route, even should the motor function of the stomach, impaired to some extent by the operation itself, be sufficient to accomplish this. The latter, likewise, interferes with its prompt evacuation by vomiting.

Chlumski,[2] in observations carried on in twenty-one cases, found that pure *circulus vitiosus* occurred but once. An analogous condition was, however, noted in five cases. In one of these the portion of intestine leading from the anastomosis was compressed by adhesions and a bridle of omentum; in the second, there was a stricture of the transverse colon; in two others there was axis torsion of the attached loop of intestine, one of which recovered after entero-enterostomy. In the fifth case, gastro-enterostomy had been performed for excessive and persistent vomiting. The cause of vomiting was not apparent, and after the operation the symptoms persisted. The autopsy revealed tubercular ulcer of the duodenum, with stenosis and typical ileus, the latter of which was probably postoperative, and not explained by the author. Neither is the site of the ulcer and stenosis given. It is interesting in this connection, however, to note that experiments upon animals, and a case occurring in man observed by Lederhose, tend to show that stricture opposite the ampulla of Vater does not cause vomiting. Chlumski finally decided that the postoperative symptoms were caused by intestinal paralysis, and cites a case by Werth (1899), in which the same symptoms occurred following the operation, and in which neither adhesions nor other cause of obstruction was found.

In experiments conducted upon dogs by Chlumski, an attempt was made to imitate the vicious circle by compelling the bile and pancreatic secretion to flow into the stomach, and at the same time providing for its exit through a gastro-enterostomy. This was done by dividing a loop of jejunum and implanting the afferent end into the anterior wall of the stomach. The efferent loop was likewise implanted into the stomach

wall. By this means the bile and pancreatic juice were carried into the stomach by the afferent loop, and then in part were returned to the same loop by way of the pylorus, the remainder entering the efferent loop which was intended to receive the contents of the stomach. The animals all died, the most striking symptoms being great thirst and diminished appetite.

Stendel repeated the experiments of Chlumski, one of his animals surviving eighteen days, and then dying of perforative peritonitis, the result of giving way of a suture. The technic of Stendel differed, however, from that of Chlumski in that the former occluded the afferent end of the divided duodenum and implanted only the efferent end into the stomach (see Kelling's experiments).

As there were some discrepancies between the results obtained by Chlumski and Stendel, the former repeated Stendel's experiments upon two dogs, with the result that both animals died with the same symptoms as those in his original experiments. Chlumski then operated upon a third dog as follows: The jejunum was divided close to the duodenum, the central end closed by Doyen's method (purse-string suture and inversion of the ends). The efferent portion was then united to the anterior wall of the stomach by a Murphy button. The only symptom which followed the operation was great thirst, which finally disappeared. At the end of four weeks the animal was entirely well.

The only essential difference between this technic and that of Stendel consists in the amount of afferent portion of the intestinal loop left in which stomach and duodenal contents could accumulate. It is likewise difficult to reconcile the results obtained by Stendel, as well as Chlumski when he employed his later technic, with those obtained by Kelling. Chlumski, however, explains the difference in the results between his own original experiments and those obtained by Stendel as follows: In the former, bile and pancreatic juice flowed constantly into the stomach, and either caused functional disturbances or were themselves destroyed by the gastric juice, with an invariably fatal result. In Stendel's operation, how-

ever, the bile and pancreatic juice collected in the duodenum, where they were retained for a considerable length of time. Following the completion of gastric digestion, the duodenum became so distended that the pylorus opened and allowed the fluids to enter the stomach, where there was not enough gastric juice to destroy them, nor could they interfere with gastric digestion.

Chlumski's explanation of the results obtained by Stendel's operation is borne out by the following case of duodenal obstruction below Vater's ampulla coming under my own observation:

M. B., aged seventy-four years, was admitted to the Methodist Episcopal Hospital with a history of obscure dyspeptic symptoms for one year, and of progressive emaciation for nine months. During the past three weeks a striking feature of the case was the occurrence of vomiting at intervals of forty-eight hours, the amount of vomited material apparently exceeding that of the food (which was exclusively liquid) taken during that time. This vomited material contained bile as well, showing that, in addition to the liquid food taken, and which had remained in the stomach, a reflux of the duodenal contents had taken place. During the intervals between the attacks of vomiting no especial symptoms were noticeable attributable to the presence of the ingesta save that, as the patient expressed it, the latter "lay heavy on his stomach" after two or three meals had been taken. This was relieved by emptying the stomach, and did not return until more food had been taken, when, at the end of another forty-eight hours, the process of emptying the stomach was repeated. A fixed tumor was easily made out just above the umbilicus. Operation disclosed a retroperitoneal growth which completely occluded the duodenum below the ampulla of Vater. Marked gastrectasis was present.

A case similar to the above is referred to by Chlumski as coming under the observation of Lederhose.

The experiments of Kelling[3] are of interest in this connection. This observer, upon the basis of experiments upon dogs, confirmed the announcement made by Hirsch in 1892,

and von Mering in 1897, that filling of the duodenum inhibited the contractions of the stomach. Kelling, in order to determine the bearing of these observations upon gastro-enterostomy, divided the jejunum, and made an anastomosis between the efferent end and the stomach, suturing the afferent end so as to form a blind pouch. He found that the food passed through the pylorus until the duodenum became filled, when the gastric contractions ceased and the dog died of starvation, in spite of the gastro-enterostomy.

The occurrence of vomiting following gastro-enterostomy, whether from the anæsthetic or from the presence of bile and pancreatic secretion, forces an increased amount of duodenal contents, and the contents of the jejunum as well, into the stomach. This occurs as a result of mechanical pressure of the abdominal muscles during the act. It is my belief that it is the latter which plays the most important *rôle* in keeping up the vomiting, or, in the case of myasthenic stomach, leading to fatal stercoræmia. This in spite of the general belief that the jejunum is empty under the circumstances attending gastro-enterostomy. That it is not always empty, I can testify from my own observations; and it must be remembered that it requires but a comparatively small quantity of the contents of the small intestine to influence unfavorably the stomach.

Kocher, in order to insure the passage of the duodenal contents past the gastric orifice in Wölfler's original method of gastro-enterostomy, and at the same time prevent the reflux of jejunal contents into the stomach, introduced his "valve method." This consists in forming a valve from the stomach wall, which opened outward and was designed to permit of the passage of the gastric contents, while preventing reflux of both duodenal and jejunal contents. The operation is open to two very serious objections, however: First, it does not guard against overfilling of the duodenum and consequent inhibition of the contractions of the stomach; and, second, however efficient it may be at first, it soon ceases to perform its functions as a valve because of cicatrical contraction of its healed edges and consequent lessening of its area.

While Kocher aimed to form a valve from the wall of the stomach for the purpose of preventing reflux from either the afferent or efferent limits of the intestinal loop, Sykow,[4] of Moscow, attempted to provide a valve in the lumen of the intestine itself. In this operation, the bowel and stomach are first sutured together with a sufficiently large area of stomach and bowel wall between the lines of suture to permit an opening of communication to be made later on through a transverse incision made in the intestinal wall. After effecting the communication with the stomach, the incision in the intestine is sutured in an overlapping manner, thus forming a valve directed towards the lumen of the intestine. The objection to this, as in Kocher's valve operation, consists in the untrustworthiness of the valve, which must certainly contract as the healing process goes on. Theoretically, it is inferior to Kocher's valve method, since it aims only at preventing duodenal reflux.

At the XI Congress of French Surgeons (Paris, 1897), Faure proposed a new procedure of gastro-enterostomy. It consists of an invagination of the stomach through a button-hole-shaped opening in the bowel. The opening in the portion invaginated is turned towards the afferent limb of the intestinal loop with the object of forming a valve at this point. The objections to this method are, first, it does not provide a sufficiently large opening between the stomach and intestine to provide against subsequent contraction; and, second, it presupposes an extent of mobility of the stomach necessary for the manipulation, which is very rarely present. Even should the valve prove efficient and cicatrical contraction not occur, the method is only applicable to benign stenosis of the pylorus and to cases of pylorectomy.

Sematzky,[5] on the basis of experiments in dogs, found the food passed through the anastomotic opening when entero-enterostomy was added to gastro-enterostomy, and lodged in the duodenum, from which it was regurgitated. The method which he advises, in order to avoid this complication, is that of oblique division of the jejunum and anticolic direct im-

plantation of the obliquely cut efferent portion into the wall of the stomach, and implantation of the afferent leg into the efferent jejunal loop.

Roux's presentation of a study of fifty cases of gastro-enterostomy [6] entitles that surgeon's opinion to respect. He prefers a method which he attributes to Courvoiser, but which is really a modification of Wölfler's second method. He calls it "gastro-enterostomie rétrocolique postérieure en Y." Following the usual steps of a posterior gastro-enterostomy, the jejunum is brought forward and divided at a point from twenty to forty centimetres below its point of crossing with the colon. The upper end is closed with a clamp and held towards the left by an assistant, and the lower end is implanted into the most dependent portion of the stomach by three layers of sutures. The upper end of the jejunum is now implanted from the direction of its natural situation, *i.e.*, from the left, into the lower one at a point ten or more centimetres below the junction of the latter with the stomach, likewise by three layers of sutures. The principal objection to this procedure is the time occupied in carrying it out. With those who, like Roux, insist upon a more rigid selection of cases, this will not be a very grave objection; its applicability to certain cases of gastroptosis, dilatation of the stomach, and non-malignant stenosis of the pylorus is insisted upon by its originator.

Doyen's gastro-enterostomy [7] was the first operation which, following the old lines of Wölfler's first method,—which is undoubtedly a time-saving procedure,—aimed to prevent the vicious circle from the passage of food into the duodenum, and gastric paresis from the same cause. This operator combined gastro-enterostomy with entero-enterostomy, and followed this by elimination of the afferent loop between the two points of anastomosis. After the usual procedure of anastomosis between the loop of intestine and the stomach, and that of the afferent and efferent portions of the loop, he divides the former. If this portion of the loop is long he resects it. The cut ends are now turned in so as to bring serosa to serosa, and sutured, thus leaving two blind pouches.

This operation is a great advance in the technic of gastro-enterostomy, but it is open to the objection that considerable time is consumed in effecting a trustworthy closure of the divided or resected ends of the afferent loop.

Luecke,[8] while acknowledging that Doyen's procedure is the most rational of all those which preceded it, called attention to the difficulty arising from the meeting of the bile and pancreatic secretion with the gastric contents at the orifice of communication between the afferent and efferent loops, the former passing in the direction of the stomach, while the latter pass in the opposite direction. In cases of muscular insufficiency, or myasthenic stomach, this circumstance may, according to Luecke, lead to some difficulty in the evacuation of the gastric contents. On the other hand, the latter may pass through the orifice of communication into the afferent loop. In order to overcome this, Luecke proposed to make the entero-enterostomy in such a manner as to secure peristalsis in the same direction, instead of in opposite directions, as in Doyen's operation. This is done by dividing the jejunum before effecting the gastro- and entero-anastomosis, instead of afterwards, as in Doyen's operation, suturing the ends, as in the latter. He then makes a lateral anastomosis between the stomach and the efferent loop, finally, a lateral entero-anastomosis between the afferent and efferent loops, each with coincident peristaltic direction. By this method of operating, the contents of the stomach and those of the afferent loop are moved in the same direction.

Up to the time of the publication of Luecke's article the operation had not been performed. While it appears to be rational, the time occupied in the procedure will, I believe, prove a serious drawback to its general adoption. The fact that it is contraindicated where rapid completion of the operation is necessary will prevent its adoption in carcinoma cases, at least.

It is not at all certain that the objections raised by Luecke to Doyen's procedure are well founded. While it may be readily seen that, if the anastomosis between the afferent and

the efferent loop is made close to the point where the latter joins the stomach, the passage of the duodenal contents, propelled in an upward direction into this short portion of intestine, might embarrass the propulsion of the gastric contents in the opposite direction; yet, if the entero-enterostomy is made at a point sufficiently low down to permit the gastric contents to become well clear of the stomach before encountering the upward current from the duodenum, the latter can have but slight influence upon the downwardly propelled gastric contents. As to the passage of the gastric contents through the orifice of communication and into the afferent limb, this is scarcely probable. Even if it should occur, it would be but in small quantities. It would be in the same condition, chemically speaking, as that which enters the duodenum normally, and would be expelled into the efferent loop again by the peristaltic action.

Witzel, of Bonn,[9] attempted to overcome the evils arising from the passage of the gastric contents into the afferent portion of the loop by combining posterior gastro-enterostomy with gastrostomy (gastro-enterostomosis externa). A soft rubber catheter of large caliber open at the end is selected and buried in the stomach wall, after the author's method. Before closing the anterior portion of the opening between the stomach and intestine, the lower end of the tube is slipped into the efferent limb of the jejunum for ten centimetres, where it is secured in place by suturing it for three centimetres to the mucosa of the intestine. The patient is fed at once through the tube with milk and brandy.

The method of gastroduodenostomy with the anastomosis upon the greater curvature, suggested by Henle and resorted to by Mikulicz,[10] was designed especially for a case of pyloric stenosis with an ulcer upon the greater curvature, gastrectasis, and vertical displacement. The anastomosis was made in close juxtaposition with the pylorus, and seems to have been entirely satisfactory throughout, although the report was made too early to determine whether or not contraction of the opening of communication would take place. The operation will cer-

tainly not be required very frequently, and is only indicated where similar conditions exist.

A review of the literature of gastro-enterostomy in recent years, as well as my own experience with the operation, teaches me that the conditions most to be feared, next to collapse during or immediately following the operation, are the occurrence of, first, the vicious circle; second, distention of the duodenum from forcible propulsion of the stomach contents directly into the afferent portion of the intestinal loop employed; and, third, reflux of the jejunal contents. While the first two may bear some relation to each other, the last named occurs independently of either of the others. If the theory which I have advanced, that the jejunal reflux is first caused by mechanical pressure of the abdominal walls upon the efferent portion of the loop forcing the jejunal contents into the stomach, is correct, every effort should be made to prevent the occurrence of vomiting. The first suggestion in this connection relates to the use of an anæsthetic for the operation. In order to prevent vomiting as an effect of the anæsthetic taking place, the operation should be done, whenever possible, under infiltration cocainization. This course would be of advantage, also, in lessening the tendency to fatal collapse which so frequently follows the operation of gastro-enterostomy. It may be that further experience will show that the use of McGraw's elastic ligature will prove of use in respect to both the jejunal reflux and the occurrence of shock and collapse as well as the possibilities of infection, since the period of time occupied by the elastic ligature in completing the anastomosis, namely, from forty-eight to seventy-two hours, corresponds closely to that in which vomiting is most to be feared, and the rapidity with which the operation can be performed and the cleanliness which it makes possible guard against shock and infection. I confess, however, to a feeling respecting the elastic ligature akin to that expressed by Codivilla,[11] who, speaking of the use of the Murphy button in gastro-enterostomy, said, "Its good function is always in God's hands."

As to the possibility of distention of the duodenum re-

sulting from the passage of food from the efferent portion of the intestine into the afferent portion, it may be said, in spite of Sematzky's experiments, that this danger is not to be greatly feared; certainly not to the extent of its occurrence in connection with its direct passage from the stomach into the afferent portion. With the orifice of communication sufficiently low down upon the efferent portion, and only large enough to permit of the free escape of the bile and pancreatic juice and at the same time insure against recontraction, neither this nor embarrassment of the gastric motor function should take place. These complications are the less to be feared, since, as shown by Kelling's experiments upon dogs, the passage of food from the stomach is intermittent in character.

This leaves us to deal with the symptoms arising from what is known as the vicious circle, whether these arise from the passage of food into the duodenum and its more or less prompt reflux into the stomach, followed by its ejection by vomiting, or from distention of the duodenum and a relative stagnation of the stomach contents from motor insufficiency. In either event the indications to be fulfilled consist in absolutely preventing any communication between the stomach and the afferent loop, and at the same time permitting of the escape of the biliary and pancreatic secretions from the duodenum, and their preservation for the purposes of digestion. Attempts at "peristalsis in coincidence" do not accomplish this with certainty, and, besides, are too dangerous, particularly the first method proposed by Luecke, for use, and valve formations are untrustworthy. Entero-enterostomy, by one or another of the methods devised, is a rational resource. Of these methods, that of making the anastomosis between a loop of the jejunum and the stomach, and subsequently establishing a communication between the afferent and the efferent portions of the loop, is the simplest and at first glance ideal. This procedure alone does not, however, prevent the passage of food from the stomach into the afferent loop, nor make ample provision for its escape after it has become lodged therein, particularly if the orifice at this point is only sufficiently large to permit of the escape of the secretions from the duodenum; to

make the latter of larger size will serve to invite the dangers to which Sematzky has called attention. The indications arising from the vicious circle, as well as overfilling of the duodenum and consequent motor insufficiency, can only be met by absolutely cutting off all communication between the stomach and the afferent portion of the loop. All previous attempts to accomplish this,—such, for instance, as Wölfler's second method of gastro-enterostomy,—by dividing the jejunum and implanting the efferent end into the stomach and the afferent end into the efferent portion of the loop, or Roux's modification of this ("gastro-enterostomie rétrocolique postérieure en Y"), Doyen's method of dividing the afferent portion of the loop after the anastomoses are established and suturing the ends so as to form blind pouches of these, and Luecke's modification of Doyen's method by dividing the jejunum first and then closing the ends and making flatwise approximation at the points of anastomosis and providing at the same time for coinciding directions of peristalsis, — all of these require an amount of time too great to render them at all safe in the class of cases in which the operation is most urgently demanded, namely, patients almost at the point of starvation. In these cases, at least, some method must be devised which shall secure to the patient the maximum of benefit with the minimum of risk.

With this object in view, I have devised and employed in these cases a method of gastro-enterostomy which consists, in brief, of first securing a communication between a loop of the jejunum and the stomach, then an entero-enterostomy between the afferent and efferent portions of this loop, and, finally, obliteration of the lumen of the afferent loop between the two points of anastomosis. I have selected the simplest and most rapid method of performing gastro-enterostomy, and added to it a procedure which occupies but a minute or two, and yet absolutely precludes the possibility of direct intercommunication between the stomach and the afferent loop. This step in the operation is accomplished by passing a No. 20 silver wire two or three times around the afferent loop at the point selected, and drawing upon the turns sufficiently to oc-

clude the lumen without strangulating the wall of the intestine. The ends are twisted together, cut short, and the ends rolled into a flat coil in such a manner as to bring the cut ends in the coil, thus guarding against subsequent injury to the surrounding structures. The accompanying illustration (Fig. 5) shows the appearance of the parts at the completion of this portion of the operation.

The application of a ligature to the small intestine for the purpose of occluding the lumen of the gut is not new. My first knowledge of it was derived from Dr. Dawbarn's work on the cadaver in the operative surgery classes at the New York Polyclinic. For a number of years I have employed it as a part of the procedure of ileosigmoid anastomosis in cases of fæcal fistula in the cæcal region, for the purpose of occluding the portion of ileum between the point of anastomosis and the fistula. Realizing that, in these cases, it would be desirable to provide for the eventual restoration of the large intestine to the use of the fæcal current, I at first employed kangaroo tendon for the ligature, but found that this material was not sufficiently stable for the purposes of spontaneous closure of the fæcal fistula. I then used a heavy silk ligature, and found this answered the purpose more satisfactorily; although, in one case of unusually large fæcal fistula following gangrene of the cæcum occurring in connection with appendicitis, the silk ligature gave way at the end of three months. In this case there was afforded the opportunity of observing whatever untoward effects might have resulted from the application of the ligature. None such were found. There was nothing to show that the intestine had been constricted, although the fistula had been free from discharge for nearly three months, the discharge returning with all its former profuseness ten days prior to the second operation. The silk ligature had given way, restoration of the fæcal current had followed, and all macroscopic evidences of the constriction which the ligature had caused had disappeared. A silver-wire ligature was applied at the second operation with entire success.

These remarks upon ileosigmoid anastomosis and occlusion of the afferent portion of the ileum are introduced for

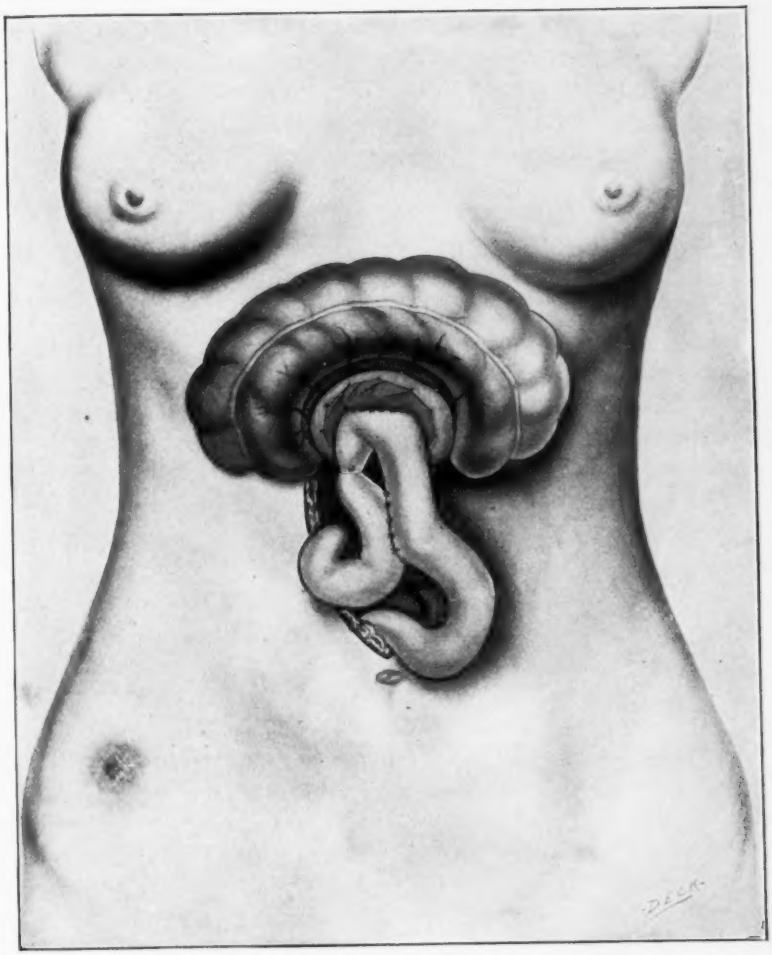

FIG. 5.—The author's method of gastro-enterostomy.

the purpose of showing the foundation of the new method of gastro-enterostomy designed to prevent the interchange of contents between the stomach and duodenum.

The procedure herewith suggested for fulfilling the last-named indication consists essentially of the following steps:

(1) Gastrojejunostomy with entero-enterostomy between the two limbs of the jejunum.

(2) Circumclusion of the afferent limb of the jejunum between the points of anastomosis by means of a silver-wire ligature.

CASE I.—L. K. H., aged forty-nine years; female. Patient admitted to the Methodist Episcopal Hospital with a history of suffering from flatulent dyspepsia for one year, with eructations of fluids and dull, aching pains in epigastrium. An acute attack of nausea and vomiting occurred three months prior to admission, since which time she has taken only liquid food and raw milk and eggs. Upon admission the patient presented an emaciated appearance. No tumor could be felt. She complained of dull, aching pains, which sometimes became sharp and lancinating, in the epigastric region.

June 29, 1901, the operation of posterior gastro-enterostomy and entero-enterostomy with circumclusion of the afferent loop between the points of anastomosis was performed. The stomach was found to be the seat of diffuse carcinoma, most marked at the pylorus.

The patient was allowed milk in small quantities, beginning on the first day following the operation; but as this caused vomiting, it was discontinued on the third day, and the patient fed by nutrient enemata, when the vomiting ceased. The enemata were not well borne, and on the fourth day the feeding by mouth was cautiously resumed. From this time the patient steadily improved, and was discharged from the hospital on the twenty-first day.

CASE II.—G. H., aged forty-seven years, was admitted to the Methodist Episcopal Hospital with a history of having been a hard drinker. One year ago he began to vomit immediately after meals. The attacks of vomiting have more recently increased in frequency and severity. Dull epigastric pain first noticed six months ago, at which time he first noticed a movable

mass through the abdominal wall, which on lying down he could see in motion. He has lost forty pounds in weight, and his appetite has greatly decreased during the past six months.

November 27, 1901. Operation of posterior gastro-enterostomy and entero-enterostomy, with circumclusion of the afferent loop between the points of anastomosis. The pylorus was found involved in a carcinomatous mass the size of a lemon, with secondary deposits in the omentum. The patient was given a saline solution enema with whiskey on the first day, and thereafter was fed by nutrient enemata the day following the operation. He had one attack of postoperative vomiting, but none thereafter. On the third day feeding by the stomach was cautiously instituted, the amount being gradually increased until the twelfth day, when he was allowed general diet, which he enjoyed greatly. He was kept in the hospital for observation for five weeks, when he was discharged. He reports at the out-patient department occasionally (seven months after the operation). He is now jaundiced, and shows evidence of hepatic involvement.

CASE III.—This is the case of duodenal obstruction related in the earlier portion of this paper. Posterior gastro-enterostomy and entero-enterostomy, with occlusion between the points of anastomosis. The patient died of cardiac failure twelve hours after the operation. No autopsy was permitted.

CASE IV.—L. B., aged sixty-one years, was admitted to the German Hospital on May 19, 1902, with a history of having suffered from "dyspepsia" for a year past. He had more recently developed vomiting, and within a few days past it was discovered that food taken the day before was vomited the next morning. He has lost greatly in flesh and strength for the past six months. Examination discloses a fist-sized tumor occupying the site of the pylorus.

May 20, the operation of posterior gastro-enterostomy and entero-enterostomy between the two loops of the jejunum was performed, to which was added circumclusion of the afferent loop. An attempt was made to perform the operation under cocaine infiltration, but the patient would not permit it. Chloroform was then resorted to, but on account of the weak heart action ether was finally substituted. The carcinomatous mass was found to extend well up on the lesser curvature, and upon the anterior wall of the stomach as well. Some difficulty was encountered in procuring a sufficiently large area of the posterior wall through the opening in

the mesocolon to serve the purposes of the gastro-enterostomy, and on account of the limited space finally obtained I was led to resort to the elastic ligature of McGraw. The entero-enterostomy was done in the usual manner, *i.e.*, first, the application of a running Lembert suture uniting the two loops, then incision of both loops and sewing the edges with catgut, and, finally, continuing the running Lembert suture so as to completely enclose the anastomosis formed by sewing the intestinal edges directly together.

The patient rallied well from the shock, and at no time suffered from nausea or vomiting. Feeding by the rectum was commenced at once, and drachm doses of milk and brandy were given by mouth twelve hours after the operation. These were well borne. He was cheerful and happy, free from all discomfort, and promised a speedy recovery from the operation, when on the second day he was seized with a left-sided pneumonia which rapidly extended. In twelve hours the right lung became involved. He died fifty-four hours after the operation.

The autopsy showed that the elastic ligature, although it had indubitably included and was deeply embedded in the stomach and intestinal walls, had not effected an anastomosis.

CASE V.—J. D., aged forty-four years, was admitted to the Brooklyn Hospital on May 21, 1902, with a history of obscure gastric symptoms extending over a period of two years. One year ago he was operated upon for appendicitis. His more recent symptoms have been regurgitation of fluids, distress in the epigastrium after eating, and flatulency. The breath is foul and the tongue coated. Examination shows gastrectasis and gastroptosis.

On May 22 the abdomen was opened and the diagnosis confirmed. No palpable alterations at the pyloric orifice could be made out. Posterior gastro-enterostomy and entero-anastomosis between the loops was performed, and to this was added circumclusion between the points of anastomosis.

The patient was given saline and nutrient enemata on the day of operation, and rectal feeding was kept up for three days. On the second day peptonized milk was given by mouth and cautiously increased. There was slight shock, no vomiting, and recovery was rapid and uninterrupted. He was kept in the hospital for observation and discharged at the end of the fourth week. He had no eructation, but complained of occasional epigastric distress. At the present time he is in excellent health.

CASE VI.—J. N., aged thirty-one years, admitted to the Methodist Episcopal Hospital, May 22, 1902. The patient gave the following history: Fourteen years previous sustained a fall upon left hypogastrium. Three months later he vomited a small amount of bright red blood. From that time till the present the attacks of vomiting, followed by distention of abdomen and jaundice, have occurred at intervals from five weeks to eight months. He has been constipated with clay-colored stools for five years; has lost much flesh and strength. Blood examination shows red cells, 3,568,000; white cells, 22,000; hæmoglobin, 55 per cent.

May 24, 1902, the operation of posterior gastro-enterostomy and entero-enterostomy, with circumclusion of the afferent loop between the point of anastomosis, was performed. Three hours after operation the patient vomited six ounces of dark green fluid, and complained of considerable abdominal pain. Shock was pronounced. The patient rallied well, however. Rectal feeding, being well borne, was kept up until the fifteenth day; feeding by the mouth delayed until the fifth day. At the commencement of the third week, symptoms of diffuse septic peritonitis appeared, and he died on the twenty-third day following the operation.

The autopsy revealed a diffuse purulent peritonitis, with a localized pus collection about the entero-enterostomy, which was found to communicate with the jejunum at a point where the insufficiently united serous surfaces had given way.

The silver-wire occlusion ligature and the intestine near it were in good condition. On opening the stomach an ulcer was found. The signs of an old splenitis and perisplenitis were also present.

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SO-CALLED HYPERTROPHIC TUBERCULOSIS OF THE INTESTINE.

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Until within the last few years the fact was but little recognized that tuberculous lesions of the intestine occasionally give rise to more or less complete obliteration of the lumen of the gut, and even now references to this condition are but rarely met with, especially in American medical literature. To Hofmeister [1] belongs the credit of first directing general attention to the subject in a very thorough and complete article that appeared in 1896. This author succeeded in collecting the clinical histories of ninety-one instances of this disease, eighty-three of which had been operated upon. Those who are interested in the early bibliography of the affection are referred to Hofmeister's admirable paper. Since this time instances of the disease have been recorded by Lennander,[2] Claude,[3] White,[4] Pantolini,[5] Besacon et Lapointe,[6] Boschgrevink,[7] Mayo,[8] Strehl,[9] Moniere,[10] Hartmann,[11] and Gross.[12] To this list I desire to add the history of the following case. For the clinical record of this instance of the disease my thanks are due to Dr. D. E. Hughes, Chief Resident Physician of the Philadelphia Hospital, but, owing to the fact that the patient was in the insane ward, there is little in the history that bears directly upon the lesions in the intestine, which in connection with the generalized tuberculosis was the cause of death.

M. K., aged thirty-nine years, white, female, a native of Pennsylvania, was admitted to the Philadelphia Hospital on June 16, 1897, with the clinical diagnosis of imbecility and epilepsy.

Father died of Bright's disease and mother of heart disease.

For seven years the patient has been now and then in the out wards of the Philadelphia Hospital for epileptic fits and vertigo, and about two months before the present admission had erysipelas in the Medical Ward. The patient's habits have always been good. On admission she was thin and somewhat anæmic, but there was no evidence of organic disease, with the exception that the urine showed a specific gravity of 1014, contained amorphous urates and uric acid and considerable quantities of albumen; there is no record of casts.

A note made February 20, 1898, states that the patient's feet are œdematous and that the eyelids are puffy, and that there is beginning evidence of ascites.

March 3, 1898, ascites increased, but œdema of eyelids and feet lessened in amount. The patient is steadily failing.

April 26, 1898, ascites markedly decreased; œdema of feet and legs almost disappeared. She is brighter and cheerful. Urine 1010; alkaline. On microscopic examination there are found pus-cells and granular and hyaline tube-casts. Albumen is present.

June 20, 1898, ascites has disappeared. Liver greatly enlarged; its lower borders reach to umbilicus. Urine contains one-sixth the bulk of albumen. She sits up part of each day.

November 10, 1898, health fair with the exception of frequent bilious attacks. Mentally is irritable.

February 11, 1899, ascites has again appeared. Abdomen much distended. Urine contains quantities of albumen and casts.

February 27, 1899, failing steadily. Ascites much lessened.

March 9, 1899. Died to-day at 6.10 P.M.

Post-mortem held at 4.15 P.M., March 10, 1899.

Pathological Diagnosis.—Nephritis and amyloid infiltration of the kidneys. Cirrhosis and amyloid infiltration of the liver. Tuberculosis of peritoneum. Atrophy of pancreas. Hypertrophic tuberculosis of small intestine, and amyloid infiltration of mucosa.

Body of a much emaciated female. There is a slight œdema of feet. Abdomen distended. Post-mortem rigidity slight. The skin of the entire body has a slightly jaundiced appearance. The abdominal wall contains practically no fat.

On opening the abdominal cavity there are found 4050 cubic centimetres of an opaque, yellowish fluid of a specific gravity of

1020. The transverse colon is pulled downward and to the left, owing to an adhesion between the omentum and the small intestine at the mouth of the pelvis on the corresponding side. In the middle line the liver is twelve centimetres below the end of the sternum; in the right mammary line the organ is one centimetre below costal margin. Above, the liver extends to between the fifth and sixth ribs. Scattered through the entire peritoneum there are small, hard, almost transparent nodules, which vary in size from those which are barely discernible to others that are three millimetres in diameter.

Left pleura contains thirty cubic centimetres of blood-stained fluid, but the membrane is normal. Right pleural cavity contains the same amount of fluid, and its coat resembles that of the other cavity. Pericardium contains a small amount of blood-stained fluid. The membrane is normal. Heart is in normal situation. The heart is quite small. The heart muscle appears normal, but the subpericardial fat here and there shows mucoid changes. Left side is contracted, but the right is flabby. The aortic and pulmonary valves are normal. The left auriculoventricular opening admits three fingers, and the left three. The edges of the mitral valves are slightly thickened, but all of the other valves are normal. The endocardium of the left ventricle is somewhat thickened.

In the apex of the left lung there are a few recent tubercles. The lung is otherwise normal. The right lung is normal.

The spleen is bound to the surrounding tissues by old adhesions. It is somewhat enlarged, weighing 270 grammes; the organ measures sixteen centimetres in length. The capsule is here and there opaque and thickened. The organ is slightly lobulated. The substance appears normal.

Both suprarenals are normal.

The left kidney is smaller than normal, and appears more rounded than usual. The substance is resistant to the knife. The capsule is so adherent that it is impossible to strip it off. On section there is found a cyst two centimetres in diameter in the substance of the organ. It is almost impossible to discern the points at which the cortical and medullary areas meet. The substance is extremely tough. The connective tissues between the pyramids show mucoid change. With the exception that there are no cysts in it, the right kidney resembles its fellow.

Ureters and bladder are normal. Rectum is normal. Uterus is normal. The ovaries are white, fibrous, and atrophied.

Duodenum is normal. Its peritoneal coating contains numerous small tubercles. Pancreas is normal; weighs only forty grammes. On section it is found to be very tough; its fibrous tissue is evidently much increased. The surface of the liver shows numerous superficial scars. At all points the peritoneum contains small, transparent nodules, that vary in size from those that can barely be seen to others that have a diameter of three centimetres. The liver is decreased in size. Its surface presents the irregularities that are always observed in advanced cirrhosis,—the depressions being, however, in most cases, even deeper and wider than are usual in this disease. On section the substance is found very tough. All through the organ numerous large, thick bands of fibrous tissue are observed.

While the peritoneal coating of the entire intestinal tract shows the small nodules which were referred to in speaking of the peritoneum in general, the mucous coat appears entirely normal except in the ileum. In this part of the tract there are found ten points at which the gut is constricted (Fig. 1); just above each of these constrictions the intestine presents saccular dilatations. One of these constrictions, situated just above the ileocæcal valve, is so extreme that water could scarcely be forced through the small opening that still existed at the point; the gut ruptured just above the constriction while this was being done. In the serous coat covering these areas there are more of the nodules just mentioned than are found in other situations, and, in addition, a considerable deposit of fibrous tissue has occurred between them, giving the appearance of old scar tissue. At these points the thickened peritoneal coating of adjacent parts of the intestine have frequently adhered, the consequent kink in the intestine aiding considerably in decreasing the lumen of the gut where this occurs. On opening the gut the walls are found much thicker and tougher than normal; at the thickest portions the wall measures eight millimetres. These areas entirely encircle the inner wall of the intestine, and extend in a longitudinal direction from .5 to 8 centimetres. On the mucous surface these areas are raised above the neighboring healthy parts, and their edges are uniform and distinctly marked off from the healthy tissues.

Anterior to the ears the skull is very thick, being seventeen

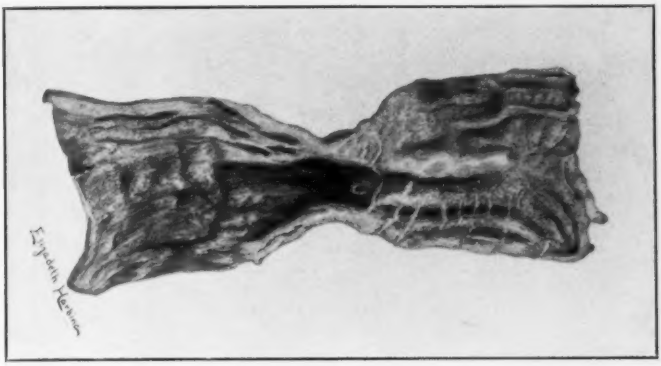

FIG. 1.—Section of ileum showing constriction.

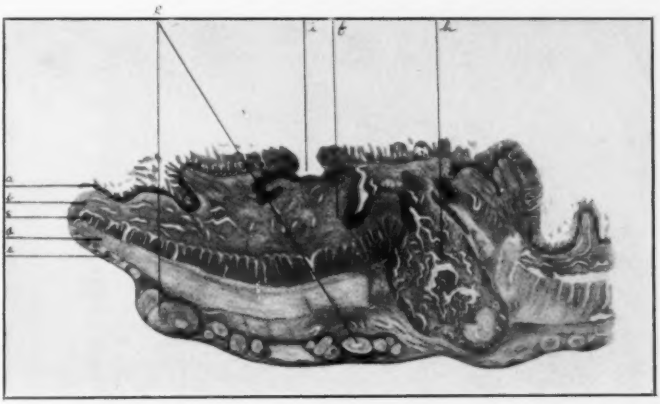

FIG. 2.—Section of the intestine under a very low power. Specimen fixed in Heidenhain's solution of mercury bichloride and stained with hæmatein and eosin. *a*, mucosa; *b*, submucosa; *c*, circular muscular coat; *d*, longitudinal muscular coat; *e*, subserous coat, within which there are many tubercles (*g*); *h*, large tubercle; *f*, thickened submucosa; *i*, small superficial ulcer.

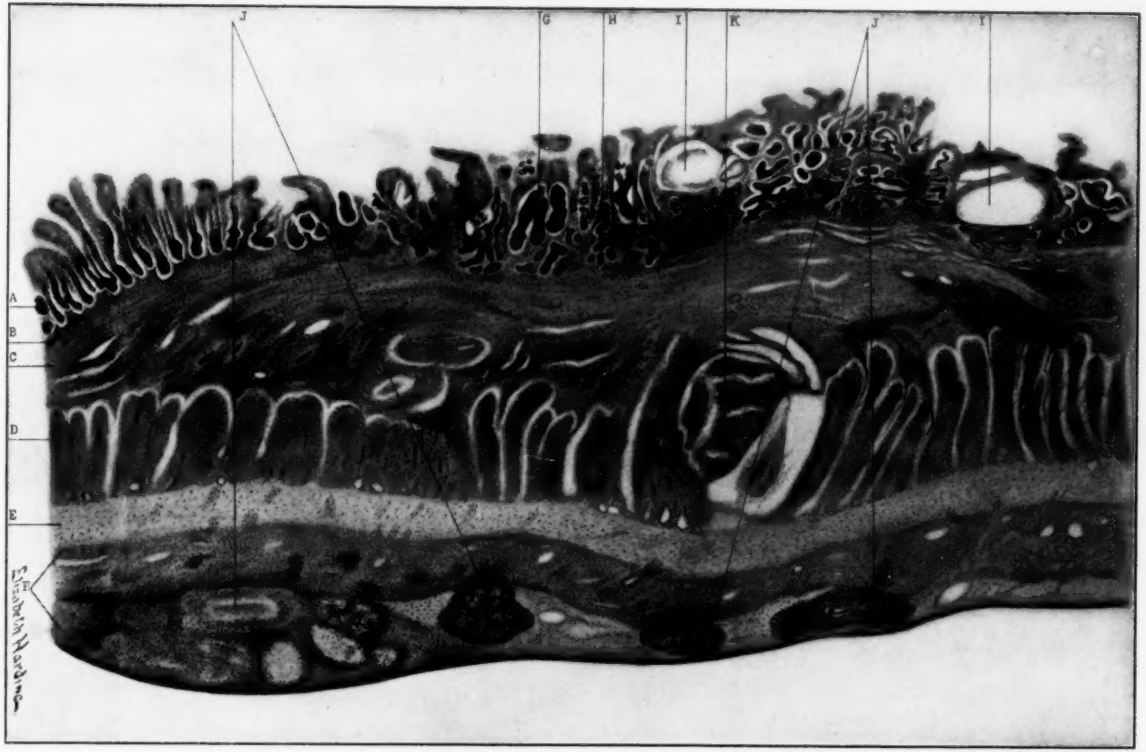

FIG. 3.—Section of the intestine at the edge of a constriction. Specimen fixed in Heidenhain's solution of mercury bichloride, and stained with carbol-toluidin blue and eosin. Beck, ¼ inch; oc., 1 inch. *a*, mucosa; *b*, muscularis mucosæ; *c*, thickened submucosa; *d*, circular muscular layer; *e*, longitudinal muscular layer; *f*, greatly thickened subserous coat, with numerous tubercles (*j*); *g*, hypertrophic crypts; *h*, dwarfed crypts; *i*, cysts; *k*, a large tubercle in circular muscular coat.

millimetres in thickness; posteriorly it is only five millimetres thick. The meninges are normal. There is perhaps more fluid in the subarachnoid spaces than is usual. The brain is very small, weighing only 950 grammes.

Microscopic Examination.—Pieces of tissue from all of the diseased areas in the intestine and sections from the kidney, liver, spleen, lungs, pancreas, diaphragm, and broad ligaments were fixed in Heidenhain's solution of mercury bichloride, and afterwards embedded in paraffin. Sections were stained with hæmatoxylin alone and with eosin, carmalum alone and with picric acid, carbol-toluidin blue with eosin, and carbol-toluidin blue followed by Unna's glycerin-ether mixture, acid orcein, and by the methods of Sanfelice, Van Giesen, and Weigert.

Intestine.—On microscopic examination the mucosa of the diseased areas is found to have undergone very marked and quite peculiar changes, although in no instance does this coat present a lesion which in any way resembles a well-marked and characteristic tubercle. At a short distance from the diseased areas the mucosa presents no alteration worthy of mention, except that the connective tissues and blood-vessels that go to make up the mass of the villi show marked amyloid change; in many of the villi the entire tissues have undergone this alteration. The tissues between the crypts also exhibit the change, but not to such an extent as in the villi. As the diseased areas are approached, the semilymphoid tissue that lies between the crypts of Lieberkuhn is seen to be increased in amount. This increase is due almost entirely to hypertrophy of the pre-existing collagenous tissue of the part; in addition there are, as should, of course, be expected, quite a number of fibroblasts, a few plasma cells, about the usual number of lymphoid cells, and here and there a small amount of amyloid infiltration. In this region there is no discernible change in the general character of the crypts of Lieberkuhn, or in the epithelial cells lining them.

Over the region of the greatest change the entire mucosa is elevated by the increase of tissue beneath. In these areas the crypts show most marked alterations, there being none present which can be regarded as entirely normal. The crypts are in some regions greatly decreased in number, while in others they are decidedly increased; these areas often alternate with each other, but in different sections one or the other not infrequently greatly predominates.

When they are fewer than usual, they are generally considerably wider and often longer than normal, and there is a comparatively wide opening in the centre, which is empty. From basement membrane to basement membrane they usually measure from 90 microns to 110 microns in diameter; the normal is from about 55 microns to 75 microns in diameter. The cells lining these glands are evidently in active proliferation, as there can be generally seen two or three rather indistinct layers piled one upon the other; the nuclei of all of these cells stain in a normal way; but it is notable that the protoplasm does not retain its affinity for basic dyes as in the healthy cells; this undoubtedly means that these cells are not engaged in the manufacture of the mucous secretion to which they normally give rise. These cells are frequently detached from their basement membrane. In exceptional instances the glands appear almost normal in every particular, but are never entirely so.

Belonging to this group of widened glands there are frequently present what appears to be cystic dilatations of these structures, but, very curiously, in no instance has a communication from a cyst to the free surface of the gut been discovered. They are oval in form, and their long axes are parallel to the mucous surface. These cysts vary greatly in size, some being but little larger than the dilated crypts above mentioned, while others are much larger; the largest are 210 microns wide by 500 microns long. They appear to be for the most part empty, or, at most, to have contained a fluid with but little solid matter; however, in some of them there is found a granular débris which is beyond doubt the remains of degenerated epithelial cells. The crypts are lined by epithelial cells which in every way resemble those in the dilated crypts before referred to, with the exception that they do not appear to be in such a state of rapid proliferation, and are more frequently detached from their basement membranes. Between these enlarged crypts and between them and the cysts there is, as a rule, a very considerable increase in the amount of collagenous tissue, and, in addition, there are many fibroblasts and quite a number of lymphoid and plasma cells. In some places a slight degree of amyloid infiltration is found. In many instances there is so much collagenous tissue and so many cells between the enlarged crypts that there are wide intervals between them. In these instances there is generally no epithelial covering of the

surface of the intervening tissue,—the collagenous tissue forming the free surface of the intestine at these points. The cysts are not infrequently covered over by a very thin layer of fibrous tissue, on the free surface of which there are no epithelial cells. The blood-vessels of this collagenous tissue are very small and few in number, and in no instance appear dilated. It is, however, notable that the walls of those vessels which are present show considerable collagenous thickening.

In those areas above referred to in which the number of crypts are increased, the mucosa is considerably thicker than normal. This thickening is the result of an increase in the crypts, which, though smaller than normal, have often proliferated to an enormous degree, and have branched and grown in every direction. In the majority of instances they have not penetrated beneath their basement membrane; but in a few sections glandular structures belonging to this group were actually found in the submucosa just beneath the muscularis; the explanation of this must be that there is in the near vicinity a small ulceration extending down beneath the muscular coat of the mucosa, and that the glands have grown down the edges of this ulcer into the tissues beneath. The crypts vary in diameter from 35 microns to 45 microns. These measurements are also from basement membrane to basement membrane. In the centres of the glands there are lumina which are in most instances entirely empty, but in some cases they contain masses of more or less degenerate epithelial cells. All of the crypts are, or have been, lined by glandular epithelium. In most instances the cells are attached to the basement membranes in a perfectly regular manner, but in others they are detached and lie in the lumina of the crypts to which they belong. The cells do not show in these smaller crypts that tendency to proliferate which was observed in those lining the larger ones, there being no more than a single layer of cells observed at any point within them. The cells themselves vary considerably in form; in the majority of instances they are distinctly columnar, but in not a few of the crypts they are so short that they are almost, and in many cases are, entirely cubical. The nuclei, as in the normal cells, are situated near their attached ends and stain in the usual way. As in the cells lining the enlarged crypts, the protoplasm of these cells do not here take the basic dye, as a rule, but, occasionally, exceptions to this rule are seen; and in these

instances all of the cells lining a crypt show a perfectly typical basophilic reaction. There is very little tissue between the crypts last described, they lying in most instances almost in direct contact with each other; but they are, of course, always separated by more or less collagenous tissue, with which there may be occasionally seen an elastic fibril. Within the tissue there are a few lymphoid cells and, very rarely, a plasma or connective-tissue cell. There are very few blood-vessels in the tissue, but here and there a small vessel may be seen, the walls of which show more or less thickening, as a result of the deposit of newly formed collagenous tissue.

The muscularis mucosæ cannot be detected beneath the mucosa in those situations where it is greatly altered, be the alteration what it may; the coat seems entirely replaced by newly-formed collagenous tissue, which is so irregularly deposited that the lower surface of the crypts presents a very irregular outline.

The mucosa is in some situations partially or entirely ulcerated away; these ulcers are in all cases so small that they can only be detected by means of the microscope. They seem to be the result of several more or less separate and distinct processes. Perhaps the most frequent form is that which is due to caseation and destruction of the underlying tissue from the tuberculous process. When this happens, the tubercle begins in one of the lymph nodes which lie within and under the mucosa, or in the submucosa, and, gradually extending, the blood supply is in a greater or less degree cut off from the superficial tissue, which also in the course of time becomes tuberculous, and they ultimately entirely give way; from this there results an ulcer opening upon the free surface of the gut. As would be expected from the method of their formation, these ulcers have always undermined edges, and often extend down to the circular muscular coat or even deeper. The overhanging edges are also in a great degree due to the muscularis mucosa, which here, as in other ulcerative intestinal affections, retards the necrotic process through its inherent power of resisting diseased producing causes. As a rule, the crypts that are in the vicinity of these ulcers show marked degenerative changes; the epithelial cells lining them are not attached to their basement membranes in a normal way, and the cells themselves are swollen, irregular in form, and show a tendency throughout the nucleus and protoplasm to stain with acid

dyes. However, in some instances they are almost normal. Occasionally these cells have grown down the edges of the ulcers into the submucosa; they then form a stratified layer, usually on one side only of the ulcer, and the cells, while showing pronounced degenerative changes, are often in a better state of preservation than those of the neighboring crypts. The entire floor of the ulcer is never covered by these cells; as they grow downward into the submucosa they become more and more degenerate, until finally they terminate in a layer of granular detritus, which evidently represents them in a state of complete degeneration. As has already been mentioned, they may nevertheless, in some cases, form crypt-like bodies in the submucosa.

The walls of these ulcers, when not covered by epithelium, are made up first of a layer of granular débris and semidegenerate cells, and, deeper into the tissues, by a layer of collagenous tissue, that contains numerous lymphoid cells, many plasma cells, quite a number of fibroblasts, and a few polymorphonuclear leucocytes and mast-cells. The tissue is almost without blood-vessels. In the layer of granular débris a few bacteria are found, but by no means so many as would have been expected. The muscularis mucosa which forms the roofs of these ulcers show, especially at the points where it is ulcerated through, decided alterations; the coat is swollen, the muscular fibres do not fully show their longitudinal striation, their nuclei do not stain well, and between the fibres there are great numbers of lymphoid cells.

The other varieties of ulcers are the results of necrosis of the diseased mucosa, whether this be of the one kind or the other which has already been described. Ulcers are also sometimes seen which appear to be the result of rupture of the cysts or of ulceration from without into them.

In the former instance the resulting ulcer is superficial, the edges are not overhanging, and the floor is made up of a very thin layer of granular débris, beneath which are the lower ends of the crypts and the various tissues that are present in those parts of the diseased mucosa where ulceration has not occurred. In rare instances the ulceration extends down to the point where the muscularis is present in the normal intestine, but, as already mentioned, this coat being generally absent where the mucosa shows pronounced changes, it would not be strictly accurate to

say that the ulcer extends to this coat; but it is noteworthy that the ulcerative process does not generally extend deeper.

Those ulcers that seem to have been caused by rupture of the cysts are quite small, oval in form, and lie within the mucosa; they sometimes extend down to the muscularis, or the tissue that represents it, and usually they present edges that slightly overhang the body of the ulcer.

In the diseased regions the submucosa is considerably thickened. This is the result of an increase in the amount of collagenous tissue and to the presence of great numbers of cells of various kinds between the fibrils of the tissue; in addition, there are found within this hypertrophied tissue small tubercles.

In the region most diseased, the collagenous tissue fibrils do not, as in health, run parallel with the surface of the gut, but pass from the muscular coats towards the mucosa in an oblique direction, and sometimes almost directly transverse to it. Between the bundles of collagenous tissue there are quite a number of elastic fibrils, but there does not appear to be an actual increase in the tissue; the fibrils seem to be more widely separated than in health, owing to the increase of the collagenous tissue between them. Within these tissues there are many swollen connective-tissue cells, and in addition great numbers of lymphoid cells, numerous mast-cells, a few plasma cells, and here and there a polymorphonuclear leucocyte. The blood-vessels of the submucosa are not increased in number. The outer coats of these vessels are in almost all cases more or less thickened, but they do not in any instance exhibit an increase in the number of cells contained within them. Some of the smaller arteries show in a marked manner the changes of endarteritis obliterans. The lymph spaces and channels are dilated, and often contain great numbers of lymphocytes.

The tubercles within the submucosa are in every way typical. Around their edges are collections of lymphoid cells, with many mast-cells and a few plasma cells; next comes a layer of swollen connective tissue and the lymphoid and giant cells, and, finally, a centrally located and cheesy area. In properly stained specimens a few tubercle bacilli were found in and around some of these tubercles.

The fibrous septa that separate the various bundles of muscular tissues are in the diseased regions somewhat thickened, and there are present swollen connective-tissue cells, lymphoid cells,

many mast-cells, and a few plasma cells. The bundles of muscular fibres are often greatly displaced and distorted by tubercles encroaching upon them from both the submucous and subserous coats; in some instances those tubercles actually penetrate within the smaller coats. More rarely a tubercle is seen that evidently had its origin within the muscular coat itself,—that is, in the delicate bundles of fibrous tissue that most probably bind them together. These tubercles make, in the majority of instances, but little progress, as the muscular tissues here exhibit their well-known resistance to disease-producing causes. Some of the tubercles are surrounded by a thin but compact layer of fibrous tissue, and have evidently ceased to grow; the enclosed portions consist of cheesy material with a few nuclei that still possess basophilic properties. The other tubercles resemble those found in the submucosa, with the exception that there are found fewer lymphoid cells around them, and, as a rule, more fibrous tissue. The individual muscular fibres are separated from each other immediately around these tubercles by lymphoid, plasma, and mast cells. In a solitary instance a tubercle extending from the muscular coat into the subserous and submucous coats was found that had become secondarily infected by pyogenic micro-organisms; in the centre of the tubercle, mixed with some cheesy material, there were numerous polymorphonuclear leucocytes, while just external to these were many greatly swollen connective-tissue cells. In specimens stained with toluidin blue and differentiated with glycerin ether there were found numerous cocci in the cheesy material between the polymorphonuclear leucocytes that were stained of a purplish hue; these cocci often occur in pairs, but more often are arranged in such masses as the staphylococci usually present in tissues.

The enlarged connective-tissue cells above mentioned have an oxyphilic protoplasm in which there are many large vacuoles; their nuclei are vesicular and take the basic stain fairly well; they are always situated at one side of the cell, never in the centre. These cells have diameters ranging from 5 microns to 12 microns.

The subserous coat is greatly thickened. This is a result of an increase in the collagenous tissue and of a great increase in the number of cells of the part, and, in addition, this tissue contains a great many small tubercles.

The collagenous tissue is notably increased in the vicinity

of the tubercles, around many of which it forms in ill-defined capsules. The tissue contains a considerable number of elastic fibres, many of which appear to be of new formation.

The general tissue contains large numbers of lymphoid cells, a considerable number of plasma and mast-cells, many swollen connective-tissue cells, and a very few polymorphonuclear leucocytes. The lymphocytes and plasma cells are especially numerous around the tubercles and along the peritoneal border, while the connective-tissue and mast-cells occur in greater number away from the points where the pathologic alterations are most marked.

The blood-vessels are not more numerous than usual; their outer walls are distinctly thickened. The lymphatics are dilated and filled with lymphoid and plasma cells.

The tubercles resemble in every way those found in the submucosa, with the exception that there is around their outer borders more collagenous tissue; these tubercles are evidently quite old, and were in all probability the primary lesions.

The Liver.—The normal liver substance is largely replaced by material that is evidently amyloid, since it gives all the reactions of this substance. This material is not deposited in a regular manner,—it replacing in many situations the liver-cells almost entirely, while in others the substance of the organ is almost normal. It is also observed that not only does the amyloid substance show no tendency to deposit first in the "middle zones" of the liver lobules, but in the beginning the "outer zones" are usually involved before any other parts of the lobules, and from this point the process gradually advances towards the centre. This advance is not a regular one, but the material forms here and there in small, irregular rounded, or oval masses, and, these gradually increasing in size, finally coalesce with neighboring collections of the same kind, the intervening liver substance being apparently destroyed by a process of pressure atrophy. In the beginning these masses seem to form in the walls of the delicate vessels between the liver-cells, but in a short time they are so increased in size that they obstruct the lumina of these vessels, and then the liver-cells surrounding them gradually atrophy and disappear. In every field many liver-cells in all stages of pressure atrophy may be seen. The nuclei of the liver-cells seem in all cases to disappear after the protoplasm of the cells. In many situations bands of newly-formed fibrous tissue are observed. These bands

usually pass off from the larger septa that normally course through the organ; in them many lymphoid cells are encountered mixed with a few plasma cells, and quite a number of fibroblasts. The branches of the hepatic artery show everywhere great hypertrophy of their muscular coats, and their adventitiæ are much thickened as a result of the formation of fibrous tissue.

The bile ducts appear normal.

The Kidneys.—The capsules are much thickened as a result of the formation of fibrous tissue within them. From the capsules irregularly wedge-shaped masses of fibrous tissue pass inward, which contain many lymphoid cells, numerous fibroblasts, quite a number of mast-cells and a very few plasma cells. As these bands pass inward, they break up into smaller ones that penetrate deeply into the substance of the organ. In the cortical region the tubules are almost entirely replaced by this newly formed fibrous tissue: but here and there a tubule persists which is so constricted that it is not more than one-half or one-third as large as the normal, and frequently contains, in addition to the epithelial cells, hyaline tube-casts, or granular débris. A little farther inward the fibrous masses alternate with areas in which the tubules are for the most part enormously dilated; these tubules sometimes measure 50 microns in diameter. The epithelial cells lining these dilated tubules are distinctly flattened.

The capsules of the Malpighian bodies have, in most cases, undergone more or less fibrous thickening. The epithelial cells lining the open spaces within these bodies usually show a certain amount of catarrhal change. The walls of the blood-vessels of the glomerules universally show most marked amyloid change, but the number of nuclei in these bodies does not appear to be in any degree diminished. The middle coats of the walls of all of the vessels of the kidneys are thickened, and, in most cases, show pronounced amyloid change.

The Pancreas.—The changes in the pancreas are limited to small tubercles which here and there begin in the capsule, and occasionally extend downward a short distance into one of the septa which pass in from the capsule. The vessels of the pancreas show some thickening in their middle coats, but in no case was amyloid material demonstrated.

The Diaphragm.—The entire under surface of the diaphragm has ulcerated away, and this aspect of the muscle is lined by a

layer of degenerate cells, which, in most places, exhibits typic cheesy transformation in the more superficial portions. At the margin of the cheesy areas there are many giant cells showing the typic arrangement of nuclei around their peripheries. It is noteworthy that these cells are in almost all cases oval in shape, and that their long axes are perpendicular to the advancing process. Around these giant cells, and still deeper beneath them, the subperitoneal coat is thickened, owing to the formation of fibrous tissue; within this area there are multitudes of lymphoid cells, many fibroblasts, a few plasma cells, and an occasional mast-cell. The smaller blood-vessels are generally somewhat dilated. The muscle of the diaphragm is practically normal, there being only here and there a few lymphoid cells between the fibres.

Specimens from the abdominal wall and from the broad ligaments were also examined, and all showed on the peritoneal surfaces small but perfectly typic tubercles.

Inasmuch as this variety of tuberculosis has been but seldom referred to by American writers, it may not be without interest for me to direct attention to some of the more important features of this affection which I have been able to gather from my study of the literature.

Etiology.—Hypertrophic tuberculosis of the intestine is a disease that occurs in both sexes with about equal frequency; out of ninety-one cases that I have collected forty-seven were females and forty-four males. The disease is most common between twenty and forty years of age, but is occasionally seen in both younger and older people. It is noteworthy that in no instance was the malady observed before seven years of age, indicating that the affection is, as compared with the ordinary form in children, quite rare, or that the diagnosis is but seldom made. In most instances the family and personal histories of those suffering with the disease have not been accurately recorded, but in quite a number of cases there was tuberculosis in some of the other organs of those affected. Eisenhardt found tuberculosis of the intestine 566 times out of 1000 post-mortems made in Munich, and out of this large

number of instances of intestinal tuberculosis the hypertrophic form was observed in only nine cases.

Morbid Anatomy.—The pathologic alterations found in instances of this disease resemble upon the whole those observed in ordinary tuberculosis of the intestinal tract. The peritoneum in the vicinity of the lesions usually contains many minute tubercules, causing the adhesion of neighboring coils of intestine to each other, and not infrequently to the omentum. These tubercles are always most numerous in the subserous coat adjacent to the intestinal lesions. When the gut is opened, its lumen is found more or less constricted,—this condition, in some instances, being scarcely perceptible, while in others complete occlusion is found. The tuberculous area is generally pale in color, and on section is found to be exceedingly tough. The microscopic changes consist essentially in the formation of small tubercles in all of the intestinal coats, with the production of scar tissue around them, and with the development on the mucous surface of many atypic and irregularly formed crypts. Above the lesions the intestine is to a greater or less degree dilated; this expansion is produced by the accumulation of fæces above the strictures, and forms a considerable portion of the tumors which are so commonly found in the living subject. The muscular walls of the gut in these situations sometimes show marked hypertrophy resulting from the constant attempt to drive the fæces through the stenosed intestine. In quite a number of instances the intestinal wall has given way, and fistulous tracts communicating with the external surfaces of the body have formed. In a remarkable case recorded by Gross,[12] the lymph nodes of the submaxillary, cervical, axillary, and inguinal regions were greatly enlarged, and at the post-mortem the mesenteric lymph nodes were likewise found to be enormously swollen, resulting in marked compression of the vena cava and the production of ascites.

Symptomatology.—The irregular character of the clinical manifestations of this affection makes it necessary to describe separately its peculiar features (*a*) during the attacks when the

patient suffers from the symptoms of intestinal obstruction, and (*b*) the intervals between them.

(*a*) The symptoms observed during the attacks have been very similar in all instances. Of these colicky pains are the most frequent, occurring to a greater or less degree in all instances. In a considerable number of cases constipation has been observed in the beginning of the attack, this to be quickly followed by diarrhœa; blood has been found a few times in the stools. During the attacks, borborygmi are almost invariably observed, there being often a very loud, gurgling noise that can be heard at a very considerable distance from the patient. At these times the movements of the intestines may be very distinctly felt, and in many cases clearly seen. Vomiting is also a symptom that is quite common, being in extreme instances fæcal in character. The abdomen is commonly swollen, and palpation generally reveals the presence of a tumor which is in the region of the ileocæcal valve in an overwhelming majority of instances. These swellings offer considerable resistance to the hand, are but slightly movable, and are usually quite tender. In all cases where the disease is suspected, the presence of a tumor is of great diagnostic importance, the clinical picture of the affection being incomplete without it. In addition to the symptoms that are more directly referable to the diseased intestine, anorexia, rapidity of the pulse, and irregular elevation of the temperature are quite common. In a number of instances the patients have suffered from pulmonary tuberculosis. As complications, hæmorrhoids have been observed several times, two of the patients had floating kidney, and convulsions have also been noted in one or two instances.

(*b*) In the intervals between the attacks the patient may be in fairly good health, though in a vast majority of instances they suffer from digestive disturbances sometimes accompanied by vomiting, and pains of a colicky character are frequently complained of. These pains may come on at intervals of months, or may be quite constant, and as the time is approached when a severe attack is beginning they may be

almost continuous. At these periods constipation is the rule, but not infrequently alternates with diarrhœa. Just before a severe attack the abdominal tumor is generally quite pronounced. These symptoms may exist in a mild form for a long period of time without exciting suspicion on the part of the patient that he is suffering from a grave malady. In one instance recorded by König the disease had existed nine years before a physician was consulted.

Diagnosis.—Perhaps in no part of the body does tuberculosis offer such an encouraging field for operative work as in the intestinal tract, since, on account of the anatomical character of the gut, the disease can here be most completely and thoroughly removed. While this is true of tuberculosis in general, it is particularly so of the so-called hypertrophic form, for the very fact that newly formed fibrous tissue is produced in considerable quantity is an evidence of the resisting power of the organism; and as a consequence the diagnosis becomes a matter of much importance.

In all forms of intestinal obstruction there occur certain symptoms more or less characteristic that first direct the attention of the clinician to the probable nature of the disease, and, as there are a great number of different causes that may give rise to occlusion of the tract, the diagnosis often presents very great difficulties. Fortunately for us in this connection it is rare where the stenosis resulting from chronic tuberculosis could be mistaken for the much more common acute causes of this condition; the symptoms of the latter come on with great suddenness, as a rule, thus differing from those produced by the lesions of tuberculosis, and, generally speaking, each form presents certain peculiarities that serve to distinguish it. Thus, for example, intussusception is most common under ten years of age; twists and knots are usually seen in the latter half of life, and occur most commonly in the sigmoid flexure of the large intestine; in occlusion by foreign bodies the history generally points out the true character of the condition, and motor paralysis of the gut usually follows blows or operations upon the abdomen. It should never be forgotten

that herniæ frequently produce occlusion of the bowel,—the condition and the symptoms produced by them coming oftentimes with great suddenness,—but in almost all instances the diagnosis can be made by a careful examining of the regions in which these conditions develop. It is of value, also, to remember that collapse is, as a rule, greater in acute cases than in the chronic ones, and that in the former visible peristalsis is rarely, if ever, observed. Acute peritonitis may simulate intestinal obstruction, but the history, in connection with the almost invariable presence of fever, will in most instances make the diagnosis clear.

Of much more importance is the differentiation between the various forms of chronic intestinal occlusion. Under these circumstances the symptoms develop much more slowly; the patient gives a history, as a rule, of alternating attacks of diarrhœa and constipation, and colicky pains are almost without exception complained of. The fæces sometimes contain blood and pus. During the attacks of constipation preceding the diarrhœa, the region in which the intestinal obstruction is present becomes tender and quite painful, gas collects above the occlusion in considerable quantity, and after the muscular coats of the intestine become hypertrophic the rhythmic peristaltic contractions can be very plainly seen, the movement finally dying away just above the site of the stenosis; loud gurgling noises may be frequently heard while these contractions are in progress. Of much more importance is the presence of a tumor which occurs in many forms of intestinal occlusion. When the obstruction finally becomes complete, the sufferer complains of great pains, quickly followed in almost all instances by vomiting, which becomes bilious, and later of a stercoraceous character, to be followed by collapse and death if the condition be not relieved.

When we meet with such a combination of symptoms, it is our duty immediately to make a complete and thorough examination for hernia; if the condition be found, and if it be reducible, we should still consider the possibility of it being at the bottom of the trouble if relief does not follow the re-

placing of the gut in the abdominal cavity, since there are many instances on record where adhesions have formed in the neighborhood of old herniæ, giving rise to occlusion of the intestine.

Of the remaining causes of chronic obstruction it is not improbable that hypertrophic tuberculosis is the most frequent, if the statistics of Eisenhardt, of Munich, can be relied upon, he having found nine instances of the disease in 1000 post-mortems. Carcinoma is perhaps, on the whole, not so common, since, according to Nothnagel,[13] this disease was found in 343 times out of 41,831 post-mortems in Vienna. While it is perhaps in some instances impossible to make the diagnosis between the two affections, we should be able to do so in the majority of instances. Carcinoma occurs in the latter half of life, while the great majority of instances of hypertrophic tuberculosis that have been recorded were found in individuals between twenty and forty years of age. Of the 343 cases of carcinoma of the intestine occurring in Vienna, just referred to, seven were in the duodenum, ten in the ileum, 164 in the colon, and 162 in the rectum; it being thus seen that in almost 50 per cent. of instances of the disease the lesion is found in the rectum, and that the affection is almost limited to the large intestine. Tuberculosis, as is well known, occurs in the lower part of the ileum and beginning of the large intestine in an overwhelming proportion of cases; out of ninety-six cases the disease was found sixty-three times in the region of the ileocœcal valve (in the appendix twice), twenty-two times in the small intestine (almost entirely in the ileum), and eleven times in the large gut. It is noteworthy that there is but one instance where the lesion occurred in the sigmoid flexure and but one in the descending colon; there is no record of the disease ever having occurred in the rectum. In both of the affections under consideration a tumor is not uncommonly found. In doubtful cases the presence of tuberculosis in the lungs or other parts of the body associated with anæmia, exacerbations of temperature, and rapid pulse may serve to make the diagnosis probable, while a profound cachexia not accom-

panied by elevations of temperature, but rather by a tendency of the body heat to be lower than normal, may be of value as indicating cancer.

Old ulcers of the intestine occasionally heal, and the scar that forms sometimes causes a greater or less constriction of the gut. Instances of this kind have been observed as a sequel to the so-called fæcal ulcers occurring in the large intestine, to syphilis, and very rarely to round ulcers in the duodenum, and to the lesions of dysentery and typhoid fever. While we cannot usually diagnose a stenosis resulting from any one of the above-mentioned causes, the absence of the signs of general tuberculosis usually makes it extremely probable that the lesion is not of this character. Of the different varieties of stenosis just referred to, the syphilitic form is certainly the most important. The disease is almost entirely limited to the rectum, and very curiously occurs in women in an overwhelming proportion of cases. Poelchen has advanced the theory that the disease is not always syphilitic, and that it results in women from gonorrhœal infection of the glands of Bartholin, with the later formation of scar tissue extending into the rectum.

Membranous colitis may be mistaken for this disease, an instance of which I have recently seen; but this error is not admissible after the membranes are passed. It is perhaps not generally recognized that in mucous colitis the membranes may collect and cause obstruction of the bowel. The first authentic record of a case of this disease occurred in the Ambassador of Charles V to France, and death resulted from the accident just referred to; we owe to Fernelius [14] the description of this case.

Adhesions are not uncommonly found around the intestinal tract, and by constriction gradually produce more or less occlusion. This generally results from peritonitis produced by operations, perityphlitis, appendicitis, and inflammatory conditions of the Fallopian tubes. As has been before remarked, bands of newly formed fibrous tissue may be also produced in the neighborhood of herniæ. The history, with a careful

examination, and the exclusion of tuberculosis in other parts of the body, will in most instances prevent error in cases of this kind.

Impacted fæces sometimes cause the symptoms of occlusion. The tumor that results from this condition is soft and doughy, somewhat movable and comparatively painless, and its size and shape change after movements of the bowels. The mass can generally be made out clearly by a digital examination of the rectum.

From the stand-point of diagnosis and from the view of possible operative procedures, the location of a stenosis of the bowel is of much importance. While it is impossible to go into the matter thoroughly in this paper, the article will not be complete without some reference to this very important subject. The following points will be of service in determining the situation of these lesions: Where the obstruction is high up in the intestine, the abdomen does not, as a rule, become greatly swollen; it should not, however, be forgotten that collections of gas may form below the constriction, and in this way obscure the diagnosis. If the lesion be situated in the large intestine, the gut becomes enormously distended, and on account of its greater size we may in some instances be able to determine that it is not the small intestine; the large gut, on account of the nature of its attachment, is somewhat more movable than the coils of small intestine. Nothnagel says that in cases of stenosis of the large intestine he has been able to make out pronounced resonances in the region of the distended gut in the posterior lumbar area. Visible peristalsis may occur in stenosis of either the large or small intestine, but it is usually more rapid in the latter. In the lesions occurring in the neighborhood of the sigmoid flexure, one-sided meteorism is sometimes very pronounced,—the distended intestine being plainly visible when the abdomen is bared. Where blood is found in the stool, and where tenesmus is marked, the lesion is most likely situated in the large intestine. When vomiting comes on early and is persistent, the lesion is commonly present in the small intestine, though exceptions to this rule not un-

commonly occur. If indican be found in quantity on the second or third day after symptoms of occlusion come on, it is very probable that the disease is located in the small intestine; the continued absence of this substance would mean that the lesion was located in the large gut.

Prognosis and Treatment. — Medical treatment can, of course, be of no avail in this malady, an operation being absolutely necessary in order to effect a cure, or even to prolong the patient's life. The statistics as regards operative interference are, upon the whole, encouraging,—sixty cases have been cured and four improved out of a total of eighty-eight operated upon.

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PERFORATION OF THE BOWEL IN TYPHOID FEVER.[1]

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During the eighteen years that have elapsed since Leyden suggested the possibility of surgical relief in typhoid perforations, the feasibility of his suggestion has received most thoughtful consideration by clinicians throughout most of the countries in the old world and in the new. Thanks to the painstaking labors of Fitz, Liebermeister, Keen, Mason, Westcott, and many others, we have had put before us and now have access to a mass of information, statistical and other, showing with almost mathematical accuracy many of the chief points in the natural history of this most fatal lesion. It may be said to occur in from 2 to 5 per cent. of all cases of enteric fever; more frequently in adults than in children; more frequently in males than in females. It occurs generally, but by no means always, during the second or third week of the fever; in the great majority of cases at some point in the distal eighteen inches of the ileum; and when the intestinal contents escape freely into the great peritoneal sac the result is probably always fatal.

The results of surgical interference, although sometimes most disheartening, have in the aggregate saved many lives. The success so far is sufficient to stimulate us all to try and do better, and my great object this evening is to receive, or perchance give, some hint that applied at the bedside or operating table may enable us to do even better in the future than we have done in the past.

[1] Read before the Chicago Surgical Society, May 5, 1902.

During the past six years 932 cases of typhoid fever have been treated in the Montreal General Hospital. Perforation of the ileum occurred in thirty-four cases, or 3⅔ per cent. In one case, of a most malignant type, with tympanites, dulled sensorium, and profound toxæmia, the perforation was first recognized at the autopsy. In thirty-three cases, the accident, if we may so call it, was recognized during life and the opening closed. Five of these recovered. In one other case the patient died five days after operation, and the pathologist reported that death was due to the typhoid toxæmia and not to the perforation. If that case be included, we had six recoveries in thirty-three cases, or 18.18 per cent. As to sex, there were twenty-one males and nine females. In three cases the sex is not stated. Of those that recovered, three were males and three females. The number of females in the recovery list is striking. There were twenty-one males operated upon, and three, or 14¼ per cent., recovered, and of nine females, three, or 33⅓ per cent., recovered. In the list published by Keen in his "Surgical Complications and Sequels of Typhoid Fever," the sex is recorded in sixty-nine. Of these fifty-nine were males, and eleven, or 18.6 per cent., recovered, and ten were females, with five, or 50 per cent., recoveries. The percentage of recoveries among the females being in each list more than double that among the males. Does the thoracic type of respiration in woman result in a more limited diffusion of the escaped intestinal matters?

As to the pathogenesis of perforation little seems to be known. In reading over the case reports, I have been struck by the frequency in which many of the patients persisted in going about, perhaps doing their accustomed round of daily duties for days, and in some instances for a week or more after the onset of languor, headache, backache, and anorexia, and I have wondered if the men had, perhaps, been the greater sinners in this direction. In one of my own cases I extracted an ascaris lumbricoides through the perforation, and in another, several yards of tænia saginata. In several cases the initial pain was complained of during or shortly after a bath. Our

Montreal records, however, do not show any increase in the percentage of perforations since the adoption of tubbing as a therapeutic measure, nor do Osler's nor Hare's Brisbane statistics.

It must be admitted that we know but little of the etiology of perforation in enteric fever. Early to bed and late to rise embodies a good working rule.

Let us now consider one of the most important and, indeed, only too often, one of the most difficult questions connected with this subject, namely, that of diagnosis.

It is easy to name the symptoms of perforative peritonitis. They are familiar to you all. And yet how obscure the onset may be. It cannot be too strongly urged that with the onset of ominous symptoms the physician should associate with himself a surgeon of experience in abdominal work.

In very few of our cases has the occurrence of perforation been immediately followed by a characteristic and definite group of symptoms. The note of alarm is pain,—abdominal pain referred to the umbilical or hypogastric regions. A very common bedside note is to the effect that " at midnight on a certain date the patient complained of the sudden onset of abdominal pain; an enema was given and followed by a stool, semi-solid or watery, which gave great or complete relief. About four hours later the pain recurred, and the abdomen was then found to be tender on pressure at some point,—more frequently in the right hypochondrium,—and more or less rigidity with rounding up." This occurs so frequently in perforative cases that one is led to exclaim, here is the first error. Instead of an enema, propose an exploratory incision. On discussing this question with the physicians, their reply is that this complaint of suddenly occurring abdominal pain is not at all uncommon in typhoid, and that nine times out of ten it is permanently relieved by an enema. The first difficulty then resolves itself into the question of differentiating between colic and abdominal pain secondary to organic lesion. It can only be done by carefully studying its associated symptoms. They

say a man is known by the company he keeps, and the same may be said of abdominal pain in enteric fever.

The first associate symptom is tenderness; the second, rigidity, and the third, fixity in one spot. If this trio—pain, localized tenderness in a fixed spot, and rigidity—are found associated, one's worst suspicions should be thoroughly aroused. There is another symptom not generally emphasized that I have come to look upon as possessing considerable significance, and that is the change in type of respiration from abdominal to thoracic. This is most readily seen by freely exposing the chest and abdomen, and is sometimes made more evident by asking the patient to take a long breath. The temperature frequently rises or falls notably, but not invariably by any means. The same may be said of the pulse. Vomiting or nausea frequently occurs.

In a patient in fair condition the above symptoms will be sufficiently developed to give the carefully trained observer a fair idea of what has happened. But there are two conditions which may mislead even the most alert. The first is the occurrence of a very small pin-point perforation, particularly if near the cæcum, where a state of rest is more possible, and especially if sealed and temporarily closed by adherent omentum or adjacent coil of intestine. The great diagnostic feature here I have found to be *persistence* of a little pain and a little tenderness and a little rigidity with fluctuation in temperature and pulse. The *persistence* of these symptoms even in a mild degree should suggest the discussion of the propriety of exploratory incision. The symptoms, if due to colic, should disappear in a few hours, or change their location. Secondly, the occurrence of perforation in a patient with a tympanitic abdomen and profoundly toxic, almost comatose, may be absolutely unrecognizable by the most astute clinician, and only be found in the autopsy room. In a sense, these are of the least importance to recognize, because these patients are probably already beyond even the tender aid of modern surgery.

I have not found the presence or absence of leucocytosis a guide to be depended on. In one case it increased 50 per

cent. in the first two hours after perforation. In another case it was only 4600 eight hours after the occurrence of symptoms of perforation. In one instance it increased from 4000 to 10,000 in six hours. I then made an exploratory incision, and found no perforation, but an apparently acute infection of the mesenteric glands. The patient made a good recovery. In another case it was only 4000 eleven hours after perforation; two hours later the perforation was closed by operation and the patient recovered. It is a symptom to be carefully observed and considered in association with the presence or absence of other symptoms, but upon which alone no great reliance can be placed. Obliteration of liver dulness is insignificant, as the free border is so often tilted up by the distended intestines, particularly the transverse colon.

We have, then, in some cases great difficulty in making a diagnosis. It is sometimes impossible to be sure that a perforation has occurred, and we are face to face with a most hazardous condition; and I think that one great step forward will be taken when we admit to ourselves this limitation of our powers of diagnosis and, after a careful study and weighing of all the indications pro and con, assume the responsibility of advising an exploratory incision in selected cases. I think there is a greater degree of true conservative surgery in such a course than in standing by with our hands in our pockets taking chances. On two occasions I have opened the abdomen without finding any perforation. In one case no cause was found for the pain, and in the other swollen mesenteric glands. They both made a perfect recovery. I need hardly say here that, failing to find a perforation, a careful search should be made for the cause of the pain in the mesenteric glands, appendix vermiformis, and sigmoid flexure.

When once the diagnosis of perforation is made, every means possible should be adopted to keep the infection localized. This can best be accomplished by arresting peristalsis so far as possible by prescribing absolute rest in bed, the withholding of all food by the mouth, avoidance of laxatives and enemata, and the application of ice to the abdomen. The wisdom of

administering morphia at this stage is questionable. It may, by relieving pain, tend to favor a longer excursion of the diaphragm and the greater effusion of the septic material from the lesion of the bowel.

The time to operate is a most important point to decide. Only second in importance to the arrival at a correct diagnosis is the question, when to operate.

There are a few ultra-conservatives who would not advise operation until there is evidence of localization, and then only an evacuation of pus. The ground for this attitude is that only then is there any chance of benefit from the operative procedure. Others would seem to show from statistics that operation should not be undertaken until after the shock has passed away, say in the second twelve hours' interval; while, again, others would operate as soon as the diagnosis is assured.

In our Montreal cases the operation was performed during the first twelve hours in ten cases, with four recoveries, or 40 per cent.; the second twelve hours in ten cases, with one recovery, or 10 per cent.

Of the twenty cases operated upon during the first twenty-four hours, five recovered, or 25 per cent.

During the third twelve hours in three cases, and they all died. In one case, forty-eight hours after perforation, died; in one case, sixty-eight hours after perforation, died; in one case, seven days after perforation, recovered, or 100 per cent.; in seven cases, time after perforation uncertain.

Of the six recoveries, one was operated on two hours after the perforation, one thirteen hours after, one eight hours, one ten hours, one five hours, and one seven days after.

The operation in the last case was really nothing more than the opening of an intra-abdominal abscess. Four of the five acute cases were operated on during the first twelve hours.

So far, then, as our experience goes, it indicates early interference. Forty per cent. of the cases operated on during the first twelve hours recovered, and only 10 per cent. of those operated on during the second twelve hours, while none recovered after the second twelve hours' interval save the one

operated on on the seventh day, and this man, as one of my friends pertinently remarked, owed his life more to the mercy of God than to good surgery.

These figures are obviously too small to form the basis of general theories or deductions, but nevertheless they are significant.

I feel strongly that early diagnosis and early operation are the two factors upon which we must depend to achieve greater success in saving the unfortunate victims of this deplorable and terribly fatal complication of enteric fever. The proposition that the sooner a hole in the intestine is closed the better, can hardly be debated. It is an axiomatic truth. As a general principle, it does not admit of argument. Granted certainty of diagnosis, the great argument against immediate operation is the presence of shock. Now, our cases marked shock generally, I think I may say in every case, indicated a large perforation, or at least the escape of a considerable quantity of contents from the gut into the peritoneal cavity. If the opening was small, intra-intestinal pressure was great, so that the total of result was the same as if a larger opening obtained. To wait for shock to pass simply means the allowance of time for the spread of the infection and the development of a condition rendering subsequent cure more and more difficult. In the majority of cases anything like shock is absent at first. We should aim to anticipate shock, and by so doing give aid while the infection is still confined to the narrowest possible area.

In many cases there is a period of a few hours immediately following the perforation during which things seem to remain almost in *statu quo*. The tension within the bowel is momentarily relieved; sometimes the little opening is for the moment closed by a fringe of omentum or a friendly neighboring coil of intestine, and the condition only begins to increase after the intestinal tension is restored or a peristaltic wave has detached the tissue lying over the opening. This quiescent period is the surgeon's opportunity. It is the opera-

tive safety period, and when once passed the dangers are greatly increased.

Operations done at this time may possibly find a beginning peritonitis from infection through the still intact base of an ulcer. This base being found suspiciously thinned could then be enfolded and closed over by a row of sutures. That a localized peritonitis can result from infection through the thin and altered base of a typhoid ulcer is now generally admitted; and that even a fatal general peritonitis may result from infection through such a base and without macroscopical perforation is proved to be true by the Munich autopsies, where peritonitis was present without perforation in 2.2 per cent. of the cases.

Recovery from perforation of the small intestine not closed by the surgeon is, I believe, extremely uncommon. The experience gained by surgeons who have opened the abdomen and failed to find any perforation, although in some instances the symptoms present were fairly definite, has developed a doubt as to the correctness of the diagnosis in cases afterwards recovering without operation or abscess formation. This idea is put very strongly by Fitz in the following language: "Since perforation of the intestine in typhoid fever may take place without any suggestive symptoms, and since suggestive—even so-called characteristic—symptoms may occur without any perforation having taken place, it must be admitted that recovery from such symptoms is no satisfactory evidence of recovery from perforation."

We have the best possible reason, then, for interfering if we think a perforation has occurred, because by so doing we give the patient the only chance there is of recovery.

Operations in the past have been too frequently undertaken, not to close a perforation and to cleanse the infected area of limited extent, but to relieve, as far as possible, a developed more or less septic perforative peritonitis, the surgeon in such cases setting himself an almost impossible task. Our experience in the sequelæ of appendicitis has taught us that the infection from the ileum is no less virulent than from the

appendix, while the patient is in an infinitely less favorable condition to resist the general toxæmia.

A few cases of infection, limited, and resulting in abscess formation, have been reported; some of them have recovered, some of them have died. To trust to the limitation of infection is, it seems to me, a reckless attitude for the medical or surgical attendant to assume.

I hold that early operation anticipates shock in most instances, anticipates perforation or rupture of a suppurating mesenteric gland in a few instances, and may occasionally be in time to relieve the conservative adhesion of omentum or other serous surface before it is forcibly separated by peristaltic or intra-intestinal pressure. I am sustained in this view by Mikulicz, who said at Magdeburg, in 1884, "If suspicious of a perforation, we should not wait for an exact diagnosis and for peritonitis to develop to a pronounced degree, but, on the contrary, one should immediately proceed to an exploratory operation, which in any case is free from danger."

Early operation should certainly save those that could get well without operation and some others that might be lost by delay.

In the two cases in which I found no perforation, ether anæsthesia was employed, and there was no shock or unpleasant symptom in either case. An exploration might be undertaken readily under local anæsthesia, and then a little ether given later on if found desirable. As to the operation itself, the incision should vary with the probable locus of the perforation. As the great majority of the perforations are near the cæcum, at least in the terminal eighteen inches of the ileum, the lateral incision is frequently indicated in early operations. If a general infection of the pelvic and small intestinal area has already developed, I find a median incision gives better access to all parts of the abdomen than any other; but if the case is recent and localized, the most direct approach is the most satisfactory, and permits the closure of the opening with the least danger of the mechanical spreading of the infection

during the necessary manipulations. For this reason in suitable cases I prefer the right lateral incision.

A number of our cases have succumbed to the second or third, and, in one of my cases, to the fourth perforation which occurred on the forty-second day after the first operation. It is therefore advisable to make a careful inspection of the distal three feet of the ileum and to sew in all suspicious-looking and feeling ulcers.

After local cleansing with gauze swabs or irrigation with hot normal saline solution, according to indications, my practice has been to leave the abdomen full of the saline solution, to insert a rubber tube down to the bottom of the pelvis and clamp it, or, if a glass tube is used, to close the end with sterilized cotton.

If the pelvis is infected, and it generally is, I believe it to be most important to put the patient in the Trendelenburg position, and to carefully cleanse the pelvic cavity. One can do this so much more thoroughly after exposing it to view.

If the patient is in good condition, without pulmonary complications or renal insufficiency, ether anæsthesia gives the surgeon a better opportunity for thoroughness, but in bad conditions, especially with renal disease, one can get along very well with local anæsthesia. These patients are often extremely toxic and apathetic. The sensorium is dulled and the sensitiveness to pain lessened.

I have not gone into the bacteriology of these cases. To work out and classify the bacterial flora in each case requires a larger staff than I have at my disposal. The reports are often in two words,—mixed cultures,—by which I am to understand that different varieties of colon bacilli are present with staphylococcus; streptococci are reported present in a minority of cases, and the typhoid bacillus in only one. In many the report is that the seropurulent fluid is sterile, although the peritonitis was clearly septic, and subsequently proved fatal.

I have purposely devoted my time to the most formidable form of perforation, viz., that into the free abdominal cavity. The more infrequent causes of peritonitis connected with the

bile passages, stomach, and spleen will afford ample scope for the exercise of surgical resource. The method of procedure in these cases must be very largely dependent upon the particular conditions found in each individual case and upon the condition of the patient.

The extraperitoneal perforations are not at all common. I have opened and drained one abscess which gradually developed in the left loin during convalescence from typhoid. There were no symptoms pointing to the kidney or spleen. The pus had a fæcal odor, and the patient, a young woman, made a good recovery. One of my colleagues in the Montreal General Hospital had a similar experience. He opened an abscess in the right loin under like circumstances, the patient making a good recovery.

A NEW METHOD OF TREATMENT FOR FRACTURE OF THE NECK OF THE FEMUR, TOGETHER WITH REMARKS ON COXA VARA.[1]

By ROYAL WHITMAN, M.D.,

OF NEW YORK.

My especial interest in fracture of the neck of the femur has been in the accident as it is seen in childhood. In previous papers I have endeavored, first, to establish the fact that it is not at all uncommon; second, to point out certain distinctions between the immediate and remote results of the injury in childhood and adult age; and third, to suggest treatment by which the disability might be remedied.

This treatment was directed more particularly to the resulting deformity than to the immediate injury, for in none of the cases reported was the patient seen by me until several weeks or months after the accident. In all the cases, nineteen in number, with but one exception, there was union, an average shortening of not more than three-quarters of an inch, and but little disability other than a slight restriction of motion, a moderate limp, and a certain discomfort during the stage of repair.

The rapid recovery from the injury indicates that in childhood the neck of the femur is forcibly depressed without complete separation at the point of fracture. The average result, therefore, in spite of non-treatment, is far better than that ordinarily attained in adult age. Yet the result is far from satisfactory, for depression of the neck of the femur, whether traumatic or otherwise, sufficient to cause even half an inch of shortening, predisposes strongly to further depression; con-

[1] Read before the New York Surgical Society, May 28, 1902.

sequently to a gradual increase of disability similar to that caused by coxa vara of the ordinary type.

For this reason I have suggested the advisability of breaking up the so-called impaction with the aim of reducing the deformity should an opportunity present itself; in other words, to treat this fracture as one would treat a green-stick fracture of the shaft of a long bone.

It is apparent that one cannot apply direct force for this purpose in this situation, but the desired result may be accomplished in another manner. The range of normal abduction of the thigh is dependent upon the upward projection of the neck of the femur, which normally forms an angle with the shaft of from 125 to 140 degrees. The extreme limit of passive abduction is reached when the neck and trochanter come into direct contact with the rim of the acetabulum. If the angle between the neck and shaft of the femur is lessened, the range of abduction is correspondingly restricted. As this limitation of abduction is a constant symptom of depression of the neck of the femur, restoration of the normal range would imply correction of deformity if the capsular ligament were normally resistant. Forcible abduction of the thigh is indicated therefore as a means of replacing the depressed neck of the femur. In this manœuvre one uses the rim of the acetabulum as a fulcrum, the shaft as a lever, and depends upon the lower border of the capsular ligament to fix the head of the femur. When the normal limit of abduction as compared with that of the other limb is reached, one may infer that the deformity has been reduced; for the weakened neck should give way before the capsule becomes sufficiently stretched to allow a subluxation of the head. If, then, the limb be fixed in this attitude of extreme abduction, repair should take place in an approximately normal position, even if the fracture were made complete by the manipulation. (Fig. 1.)

Recently I have had the first opportunity to test this treatment. A boy eight years of age was brought to me by his family physician on October 30, 1901. Three weeks before, he had fallen

from a fire-escape to the pavement, a distance of about fifteen feet, sustaining bruises about the left hip, the resulting symptoms of discomfort, weakness, and local sensitiveness being aggravated by his attempts to walk. On examination, shortening of half an inch was found in the length of the limb; the left trochanter was prominent and elevated; motion was somewhat painful, and was limited by voluntary and involuntary contraction of the muscles. This limitation was most marked in the direction of abduction.

The child was anæsthetized, and it was then found that the movements of the joint were practically unrestricted except in

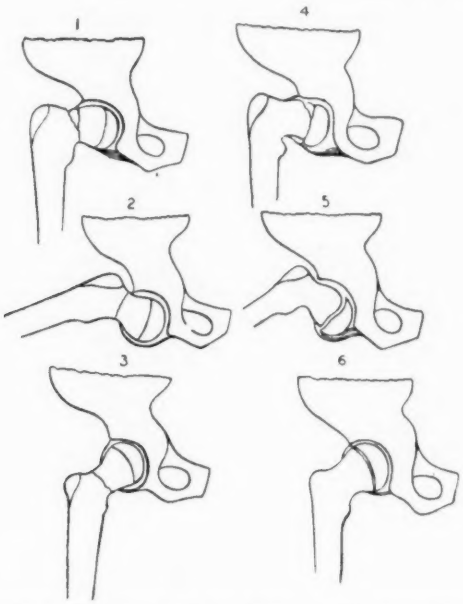

FIG. 1.—1. Fracture of the neck of the femur. 2. Restoration of the normal angle by forcible abduction. 3. The limb in normal position. Figs. 4, 5, and 6 illustrate separation of the epiphysis of the head of the femur treated by the same method.

abduction, which was limited to about half the normal range. The thigh was slowly and forcibly abducted in the manner described, to the normal limit as compared with its fellow, and the limb was fixed in the attitude of complete abduction by a long plaster spica bandage. Some weeks later this was replaced by a short Lorenz bandage, in an attitude of lessened abduction. At this time the

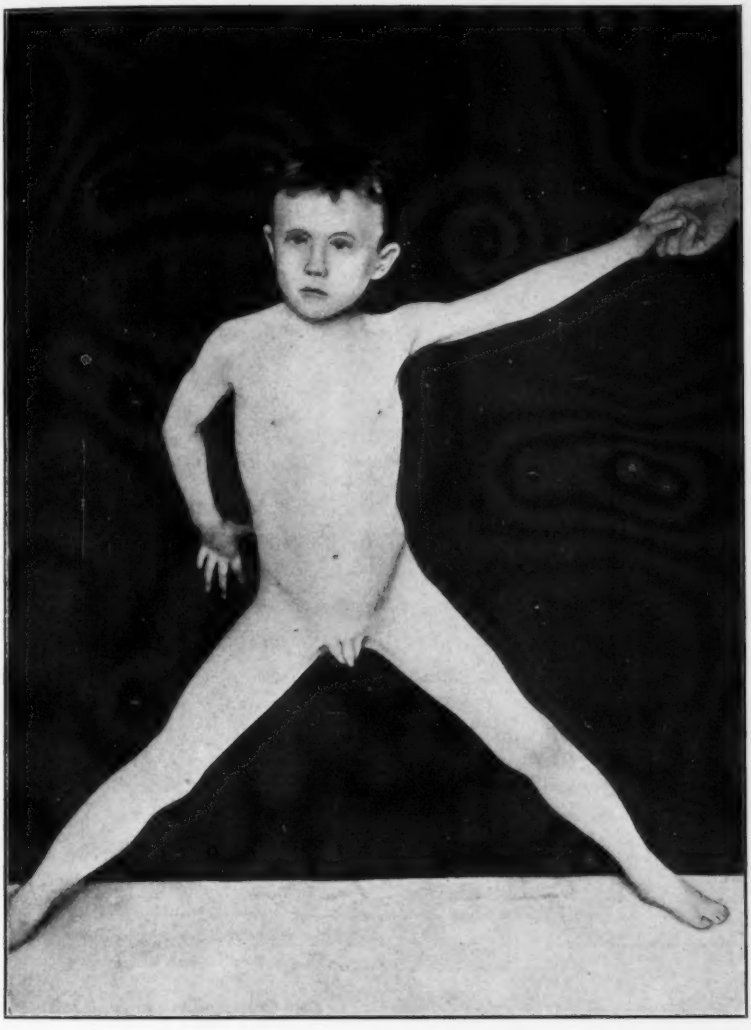

FIG. 2.—The patient after the removal of the plaster bandage, showing the restoration of the range of abduction.

limbs were of equal length; the trochanter was in normal relation to Nélaton's line, and the abnormal projection had disappeared.

It may be of interest to note that the child had been walking about practically from the beginning of treatment, the mother stating that it was impossible to keep him quiet after the discomfort had been relieved. On February 26, 1902, or about four months after the accident, all restraint was removed. There were at this time no physical signs of the accident, and a Röntgen picture showed restoration of the normal angle of the neck. The functional result is perfect.[1] (Fig. 2.)

I am convinced that the treatment adopted in this case, that is to fix the limb at the limit of normal abduction under anæsthesia by means of a plaster spica bandage, might be applied to patients of adult age with advantage, and that it offers a prospect of a far better ultimate result than that usually attained by the ordinary methods of treatment.

In the cases of this class that I have had the opportunity to examine, excluding those in which no serious attempts to secure union had been made, there is, as a final result, almost always shortening, marked limitation of abduction and, in many instances, fixed adduction of the limb with corresponding functional disability and its attendant discomforts. The disability is aggravated doubtless in certain instances by premature use of the weakened part, but it is caused primarily by a deformity that has never been reduced, or that, if reduced, has

[1] Since this paper was written, the method has been applied in a second case. The patient, a girl six years of age, was brought to the hospital for Ruptured and Crippled on August 21 of the present year. Three weeks before, she had fallen from a second story window, injuring the left hip.

For two weeks she was practically confined to bed, and, as the limp and discomfort persisted, it became apparent that the injury was more serious than had been supposed. The symptoms and physical signs were identical with those of the preceding case, as was the treatment. After the limb had been forced to the limit of abduction, it was replaced in the normal attitude for comparison with its fellow. The abnormal projection of the trochanter had disappeared and the limbs were of equal length, a convincing demonstration of the fact that the deformity had been rectified. The child is still wearing a support, but complete cure is practically assured.

again recurred. The museum specimens show also, in many instances, either non-union or exuberant callus formation that must have interfered very decidedly with function. Such results indicate failure in the apposition and fixation of the fragments.

I need not review the familiar methods of treatment of this injury. It is sufficient to say that if the aim is reposition and subsequent retention in normal position, they are faulty in conception and in practice. If, however, the patient were anæsthetized, and if, under traction and counter-traction, the thigh were abducted, it would seem that the outer fragment which would be turned downward and inward would be far more likely to be brought into apposition with the inner fragment than when the limb is held in the line of the body. If reposition were attained, it could be assured by the long plaster spica bandage, for this would provide the anteroposterior support that is lacking in the ordinary splints; while upward displacement, supposedly caused by muscular action, would be prevented by the direct contact of the outer extremity of the neck and the trochanter with the rim of the acetabulum and side of the pelvis.

The plaster bandage is said to be uncomfortable and inefficient, but from my own experience with it, both in the treatment of children and of adults, I am inclined to think that the discomfort is due rather to its improper application and to the failure of subsequent supervision than to any inherent defect of the method. The only appliance that compares with it in efficiency of support is the Thomas hip-brace; but this is equally difficult of adjustment, and it does not permit the attitude of abduction, which is the point of special interest in this connection.

I again take the opportunity to call attention to the statement in the text-books of general surgery that fracture of the neck of the femur is extremely uncommon, except in old age, a statement manifestly misleading and untrue. In addition to twenty cases of fracture of the neck of the femur in childhood and adolescence that I report, I have seen during the past year

five cases in early adult life (twenty-eight to forty-five years). One patient had been examined by an ambulance surgeon and assured that he was simply bruised. One was discharged after a stay of two days in a hospital with the same assurance. Two patients had been treated in a hospital for fractures at the ankle, the injury of the neck of the femur having escaped notice. In the last case no diagnosis had been made. In all these cases the fracture was undoubtedly impacted, and it would seem that in this class, as in childhood, the fracture is often incomplete.

It would appear from my own experience that it is a correct diagnosis, rather than the fracture, that is uncommon, and I should suggest the importance of careful measurement in all cases of injury about the hip, for if one found actual shortening of the limb, he could scarcely overlook the confirmatory signs of fracture.

As regards the treatment of impacted fracture, I may state that under favorable conditions I should not hesitate to attempt to reduce the deformity in the manner already described, a procedure which is a radical departure from traditional methods.[1]

Fixation in the attitude of abduction has been considered thus far with especial reference to the fracture itself, but it should be of service also in preventing the additional limitation of the range of abduction, caused by accommodative shortening of the muscles during the period of fixation.

[1] I am now able to report a case in which the method has been applied. A woman, twenty-eight years of age, was referred to me for diagnosis on January 29, 1902. Five weeks before this she had fallen on the street, injuring the right hip. She was assisted to her home, and had since remained in bed. On examination, the limb was found to be flexed and adducted. Motion was painful, and was restricted by voluntary and involuntary spasm. Under anæsthesia the distortion was reduced, but it was impossible to force the thigh to the extreme limit of abduction, apparently because of the changes incidental to repair. The limb was placed, therefore, in moderate abduction and a Lorenz spica was applied. Four weeks later the patient was allowed to go about on crutches. At the present time (October) the patient walks with but slight limp. There is half an inch of shortening and practically no restriction of motion. This result is not as perfect as that attained in the two other cases reported, but it is certainly satisfactory.

There is another point in the treatment of fracture of the neck of the femur that deserves consideration. This is the desirability of protection of the weakened part for a time, after ambulation is resumed. For it is probable that functional use before repair is complete may increase the deformity and aggravate, it may be, the so-called rheumatoid changes that are sometimes observed after fracture. For this reason I have employed, in the after treatment of some of these disabled patients, the ordinary hip splint as a traction appliance in the more painful cases, or as a simple perineal crutch when complete or partial removal of the strain was indicated. This support relieves the discomfort and enables the patient to walk about without the aid of crutches. It is perhaps needless to insist upon the importance of massage and of forcible manipulation for the purpose of resisting the tendency towards adduction of the limb, as an adjunct to mechanical treatment whenever it is practicable.

I have placed what may be considered the more practical part of this paper in a section by itself. There are, however, other points of interest that are involved in a consideration of disability due to deformity of the upper extremity of the femur. For example, the exact location of the injury of the neck of the femur in childhood is of importance, at least from the stand-point of prognosis. I have always contended that, when subjected to direct violence, the neck of the femur should break at its weakest part, or about its centre, rather than at the epiphyseal junction; for this is the thickest part of the bone, and it is protected by a strong rim of cartilage, which is far more elastic than the bone. Moreover, that free motion at the hip-joint, except in abduction, when there are three-quarters of an inch shortening of the limb, as in the majority of the cases that I have reported, is an almost positive indication that the injury does not involve the articulating surface of the head of the bone. For if there were true epiphyseal separation to the extent that would explain this shortening, the irregularity within the joint would cause far more serious functional derangement. This contention has been supported in a number

of cases in which X-ray was available for diagnosis, and by several anatomical specimens as well. I may state again, therefore, that, in all but very exceptional cases, in childhood the neck of the femur will give way at some distance from the epiphyseal junction. In adolescence, however, the newly formed bone about the epiphyseal cartilage is apparently a weak point. This is indicated by the fact that the deformity of coxa vara of the adolescent type is often most marked at this point. Such cases of coxa vara in which the disability is suddenly increased by a fall, or even by a slight injury, may be mistaken for true primary epiphyseal separation, and several cases have been reported as such. The following case is an example of this class.

A boy, fourteen years of age, of large size, who had for several years used a crutch because of amputation of the thigh, was brought to me on January 2, 1902. Eight weeks before this time he had slipped and injured the right hip. Immediately after the fall he was placed in bed, and remained there for two weeks, suffering somewhat from discomfort and stiffness in the joint. For about six weeks he had been about on crutches. There were marked flexion and adduction of the thigh and almost complete limitation of motion in all directions. A diagnosis of partial epiphyseal separation was confirmed by an X-ray picture. On careful questioning, it then became evident, from a history of increasing discomfort and stiffness in the hip-joint for several months before the accident, that the injury had simply hastened the progress of coxa vara of the epiphyseal type.[1]

This case is identical with two reported by Sprengel (*Archiv für klinische Chirurgie*, Band xlvii, S. 805) in youths respectively seventeen and eighteen years of age, in which epiphyseal displacement followed slight injury. In both cases discomfort and a certain degree of disability had preceded the accidents for an indefinite time. Such cases should not be classed as examples of epiphyseal separation in normal subjects, nor are they of particular importance in their bearing

[1] This patient was treated by the forcible abduction method, and at the present time the result appears to be very satisfactory.

on the question of the relative frequency of fracture and epiphyseal separation in childhood, as is assumed by Sprengel and by others. That true epiphyseal separation may occur is of course admitted. The following case, that I have already reported, is an example.

A boy, sixteen years of age, came to the Hospital for Ruptured and Crippled on October 10, 1899, walking with the aid of a crutch. Three weeks before, while playing foot-ball, his left thigh was violently abducted. This strain was followed by pain and weakness, which so increased on the use of the limb that he required assistance to reach his home. The attitude of the limb was one of slight flexion and outward rotation. There was an inch of shortening with corresponding elevation of the trochanter, and motion was much restricted in all directions. A Röntgen picture showed partial epiphyseal separation. The later history of this case differs from that of fracture of the neck of the femur in that motion of the joint has remained restricted as at the first examination. At the present time there is nearly two inches of actual shortening, which is increased to three inches by adduction of the limb.

I think it is fair to conclude that, as compared with fracture of the neck of the femur, epiphyseal separation is uncommon; that it is more likely to occur in adolescence than in childhood, and that in certain of the reported cases progressive deformity of coxa vara of the epiphyseal type preceded the injury. True epiphyseal separation should be treated in the manner suggested for ordinary fracture, as abduction of the thigh would be the attitude most likely to approximate the fragments. Excision of the head of the femur as performed in Sprengel's cases can hardly be recommended as a treatment of routine. The immediate result of excision, in the sense of restoration of motion, is favorable; but, as a rule, progressive shortening and deformity follow, because there is in most instances upward displacement of the shaft upon the pelvis, with disability similar to that of dorsal dislocation of the hip. If, therefore, an open operation is performed, one should either

attempt to actually replace the head of the bone or to simply cut away the projecting portions that interfere directly with movement. Afterwards an osteotomy of the shaft may be indicated to restore the normal angle of the neck.

The discussion of the immediate rectification of traumatic depression of the neck of the femur offers an opportunity for a further note on the treatment of the deformity when direct replacement is impracticable, as in the ordinary type of coxa vara, traumatic or otherwise. In such cases, after the forcible stretching of the contracted tissues, one should restore the normal angle between the shaft and the neck by removing a sufficient wedge of bone from the base of the trochanter. In this operation, as I have suggested in former papers, a portion of the cortex at the apex of the wedge on the inner side of the femur, opposite the trochanter minor, should be preserved. The thigh is then gently abducted, and, the trochanter and neck being fixed by direct contact with the upper border of the acetabulum, further abduction closes the wedge-shaped opening. The limb is then retained in this attitude of complete abduction by a plaster spica bandage until union is complete. The short, or preferably the Lorenz, spica will fix the part securely, for, as the continuity of the femur is unbroken, there is no danger of rotation or other displacement of the fragments. Within a few weeks the patient may be allowed to walk upon the limb, for in this attitude of complete abduction the body is so inclined towards the limb that the line of weight is practically that of the neck of the femur, and functional use that does not entail overstrain aids repair. (Fig. 3.)

This operation, performed in the manner described, is better adapted to the treatment of children than for older patients, because in the latter class what might be called retroversion of the neck is usually combined with the depression. In fact, in certain instances, this retroversion, which rotates the foot outward and limits the flexion of the thigh, may be of greater importance than the actual depression, as is illustrated in the following case.

A woman, twenty years of age, applied for treatment at the Hospital for Ruptured and Crippled because of stiffness and discomfort of indefinite duration in the right hip. She could not walk a block without extreme fatigue, nor could she sit with comfort because of the difficulty of flexing the hip. There was slight adduction of the thigh, which was so increased by flexion that the patient was obliged to cross the leg over its fellow when she assumed the sitting posture; there was also outward rotation of the limb and a marked limp. In this case the depression of the neck of the femur was so slight that there was less

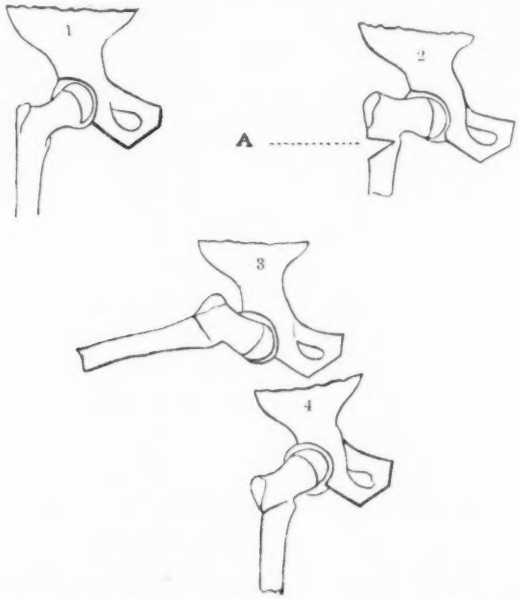

FIG. 3.—1. The normal femur. 2. Depression of the neck of the femur—coxa vara. *A*. A wedge of bone has been removed. 3. Abduction of the limb first fixes the upper segment by contact with the rim of the acetabulum, then closes the opening in the bone. 4. Replacement of the limb after union is complete elevates the neck to its former position.

than half an inch of actual shortening, the physical signs depending in great degree upon its retroversion. On July 11, 1901, after preliminary stretching of the secondary contractions of the soft parts, the femur was divided below the trochanter minor. The shaft was then rotated inward sufficiently to bring the foot into

FIG. 4.—Bilateral coxa vara in adult life, illustrating complete loss of abduction of the thighs.

normal position, and the limb was fixed in an attitude of moderate abduction by a long spica plaster bandage. Eleven weeks after the operation she resumed her work as a servant. At a recent examination the limbs were found to be equal in length, flexion was possible nearly to a right angle, and the patient stated that she could walk a distance of several miles without discomfort.

In cases of this type, and, in fact, in the majority of cases of the adolescent type, simple linear osteotomy is the operation of choice.

Although cases of coxa vara in the progressive stage are sufficiently common, comparatively few of the remote results have been reported. In this connection the following case may be of interest.

A man, fifty-two years of age, was seen in October, 1901. He stated that at the age of sixteen he had suffered from obscure symptoms of discomfort in the hips and thighs with gradually increasing disability, until at the age of twenty, in spite of, or as he thinks because of, the various remedies that were prescribed, he became bed-ridden. He then discontinued all medicine, and thereupon improved rapidly and regained his usual health, although the limitation of motion at the hip-joints persisted, making locomotion somewhat difficult. Within the past year or more he had again begun to suffer discomfort, more particularly in the right hip. Examination showed typical bilateral coxa vara. The patient was unable to separate the thighs more than a few inches, and had always walked with one limb behind the other. Motion was extremely limited in both joints, and apparently there were so-called rheumatoid changes on the right side which were the cause of his more immediate discomfort. It is interesting to note that until this time he had not been informed of the nature of his disability. This case is an illustration of late, although even after thirty years, not a final result of neglected deformity. (Fig. 4.)

It may be stated that there is no possibility of a spontaneous cure of coxa vara, in the sense of restoration of the normal angle between the shaft and the neck of the femur. During the progressive stage of the affection there is usually

local discomfort in the weakened part and, as a result, secondary muscular spasm and contraction. When the progress of the deformity is checked by the resistance of the compressed bone, and by relief from strain incident to the enforced inactivity of the patient, repair begins. The muscular spasm disappears; the contracted tissues relax somewhat under use, and an unconscious adaptation lessens the functional disability. This completes the so-called cure.

If a diagnosis of coxa vara is made in the early stage, its further progress may be checked, temporarily at least, by appropriate mechanical support. This treatment will relieve the secondary muscular spasm and the direct discomfort in the more advanced cases. It must be continued, however, for an indefinite time, and there is a probability of the recurrence of the symptoms when ordinary use of the limb is again permitted. It is essentially a palliative rather than a curative treatment. For this reason I am in favor of the operative procedures that have been described, whenever they are practicable.

The most favorable cases are, of course, those of the unilateral type in which the depression involves the neck as a whole. In this class perfect functional cure may be expected. The least favorable are the cases of the rapidly progressive bilateral type in which the distortion is most marked in the vicinity of the head of the femur. In cases of this class, forcible abduction of the thighs in the manner described may correct in some degree the deformity, and it may be employed as a tentative measure when more radical treatment seems to be contraindicated. (Fig. 5.)

It is well known that knock-knee and bow-leg can be cured by immediate over-correction of the deformity, and, as has been stated, simple coxa vara may be as effectively remedied by the same treatment. This statement would hardly require argument were it not that the nature of coxa vara has been obscured by the inferences and speculations of those who have written upon it. Certain writers speak of the deformity as an effect of a " recrudescence of general rickets;" others explain

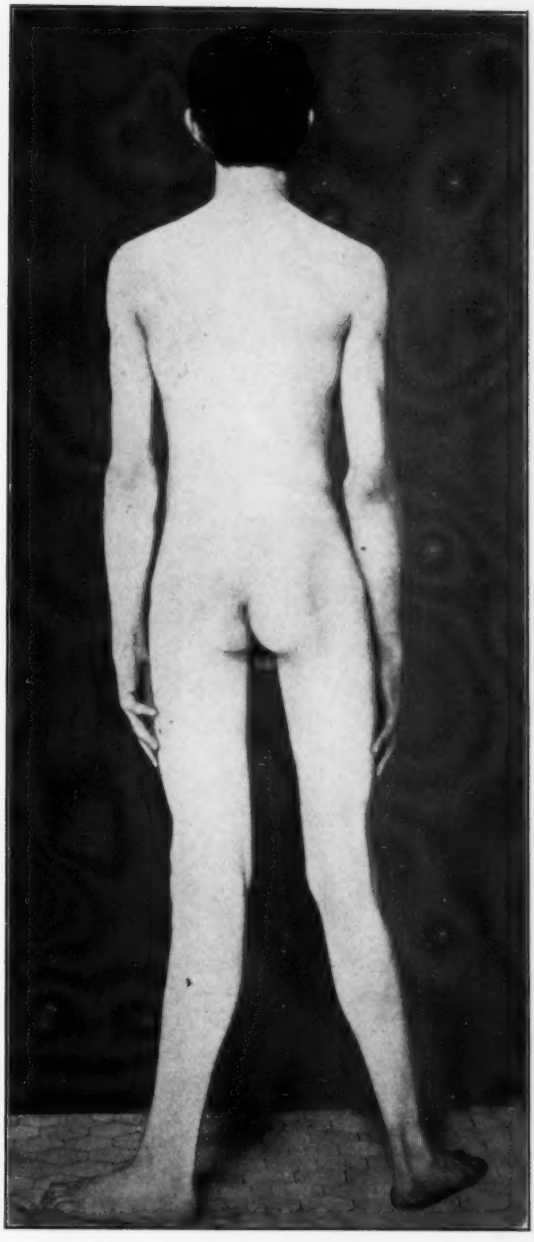

FIG. 5.—Typical bilateral coxa vara in adolescence, showing the greatest possible separation of the thighs and the outward rotation of the left limb.

it by the assumption of a peculiar local disease that begins without cause and ends as mysteriously. It is a matter of common observation that, in the cases of coxa vara of later childhood and adolescence, there is practically never general rhachitis, and there is no adequate evidence to support the assumption of local osteomalacia as a cause of the deformity. Certainly, if such a disease were present. the distortion would recur after operative treatment, yet in my experience this has never happened.

It is reasonable to assume that in many instances the deformity of coxa vara as seen in adolescence is, like other deformities of this class, simply an exaggeration of a slight preexistent distortion. This develops in adolescence because this period of rapid growth and instability is a period of weakness, when, too, the burden of laborious occupation is often assumed. Coxa vara to a slight degree is often present in ordinary infantile rhachitis, as has been demonstrated by Fiorani, but it is masked by the more evident distortions of the long bones. As it is usually slight in degree, it does not cause of itself noticeable symptoms, although, as has been stated, it is undoubtedly a predisposing cause of more extreme deformity in later life.

In certain of the cases of adolescent coxa vara, particularly of the bilateral form, the patients may present every evidence of general weakness, but even in this class a very much larger proportion suffer from weak feet or round shoulders or knock-knees than from coxa vara. This general weakness, incidental to rapid growth, may be exaggerated, of course, by improper food and environment. It is a predisposing cause of any bodily deformity; it should be recognized both in preventive and curative treatment, but it hardly deserves the title of rickets, recrudescent or otherwise.

It is well known that the angle formed by the shaft and neck of the femur is considerably less in the adult than in the child, a gradual depression being incident apparently to growth. In certain instances the femoral necks may be abnormally weak and delicate in structure, or the presence of congenital fissures

in the neck, as described by Wolff, may predispose to abnormal depression as the part develops. The effect of injury in actually causing the deformity has been mentioned, and it is probable that the injury as a predisposing cause of coxa vara is a more important factor in the etiology than has been generally believed. Finally, it may be admitted that there may be instances in which the deformity is caused by the local softening that has been mentioned. It is certain, however, that in most cases the congestion and weakness that have been found at operation are the results of progressive deformity rather than its cause.[1]

In conclusion, I present a summary of the cases of depression of the neck of the femur that have come under my observation. Twenty-one of these were traumatic (fracture) and fifty-two were simple coxa vara, a total of seventy-three cases.

Statistics of Fracture of the Neck of the Femur in Early Life.—Sex, males, 10; females, 11. Age, two to three years, 2; three to six years, 8; six to nine years, 7; sixteen years, 2; eighteen years, 2. Nature of the accidents: One patient fell from the sixth floor of a house; two patients fell from the window of a fourth floor; one patient fell from the window of a third floor; one patient fell from the window of a second floor; seven fell from heights averaging fourteen feet; four fell down flights of stairs; one was run over by a cart; one was knocked down by a street-car; one was injured in a game of foot-ball; in one case the history is indefinite.

In one case the patient was treated in a hospital, and in this case excision of the head of the femur was performed because of non-union. In two cases already described the deformity was rectified soon after its occurrence. The remaining eighteen cases received no immediate treatment for the injury.

Statistics of Coxa Vara.—Sex, males, 37; females, 15.

[1] In this review of the etiology of coxa vara, those cases due to evident local or general disease in which the deformity is, as it were, incidental, have not been considered.

Age (when the patients applied for treatment): Adolescence (twelve to eighteen years), 33; later childhood (five to eleven years), 15; adults, 4. Age when symptoms were first noticed: Adolescence, 28; later childhood, 15; childhood, 8; indefinite, 1. Character of deformity: It was bilateral in nine cases, unilateral in forty-three,—twenty-three of the right and twenty of the left side. In three instances the distortion was apparently forward and downward; in three directly downward, and in forty-six it was downward and backward.

Many of the cases were observed before the X-ray was available for exact diagnosis, and in other instances this examination was impracticable. It is estimated, however, that in about one-quarter of the cases the deformity was most marked in the vicinity of the head of the femur (epiphyseal coxa vara). This is especially common in those cases that develop rapidly in adolescence. In the remaining three-quarters the entire neck was depressed (cervical coxa vara). In fourteen there was a definite history of infantile rhachitis. In many cases no definite conclusion could be reached on this point, and in the larger proportion of the cases there was no history or sign of this affection.

THE IDENTITY OF PROTEUS INFECTION AND HOSPITAL GANGRENE.[1]

A CASE OF MIXED INFECTION WITH ÆROGENES CAPSULATUS AND PROTEUS VULGARIS.

By GEORGE R. WHITE, M.D.,

OF SAVANNAH, GEORGIA.

THE patient is a boy, eight years old, living near the Ogeechee Swamp and suffering from chronic malaria. June 4, 1902, he received a compound comminuted fracture of the middle of the left thigh by the accidental discharge of a shot-gun loaded with bird-shot. The local physician made a digital examination of the wound, and sent the patient to Drs. Corbin and Lattimore, in Savannah, for amputation of the thigh. When examined just before the operation, and about thirty hours after the accident, the wound was already stinking and discharging a dark, watery fluid. The charge of shot had passed through the middle of the femur, and pulverized the bone so completely that there was no possibility of saving the leg even if the wound had not been infected. The thigh was amputated as high as possible, and none of the lacerated tissues were left behind. The lower edges of the flaps were sutured and the angles of the wounds packed with gauze. Temperature reached 100° F. during the night; pulse, 140. At the dressing the next day the wound was very offensive and discharged a dark, watery fluid. The surface of the wound was covered with a dark gray slough not easily detached. There was not much inflammatory reaction. The middle of the anterior flap was already gangrenous, and a similar area of gangrene the size of half a silver dollar was located at the inner angle of the wound. The gangrenous areas were of a yellowish-green color, and the epidermis was lifted up by small air-vesicles. A distinct

[1] Read before the Savannah Medical Society, June, 1902.

gaseous crepitation was felt when the flaps were pressed upon. Material was taken for a bacteriological examination, the result of which is reported below. At the second dressing the gangrene had extended a little, involving the lower half of the anterior flap and the edge of the posterior flap. After this the gangrene ceased spreading and gaseous crepitation could not be felt after the second dressing. The odor of the wound continued to be most offensive, resembling stinking meat. After a week, the gangrenous part of the anterior flap sloughed off, leaving the posterior flap exposed and covered with a dark gray slough which seemed to involve the fascia and subcutaneous tissue and leave the muscles unaffected. Subsequently, the sloughs separated and left the individual muscles standing out distinctly. After the sloughs came away the wound became less offensive and began to discharge ordinary pus. After three weeks the wound was granulating nicely, and there is every promise of a speedy recovery.

Bacteriological Examination.—Cover-glass smears from the sloughs show two distinct forms of bacilli. One is a long, thick bacillus about six microns in length and occurring frequently in pairs, with the ends joined together and sometimes side by side. The other is a short, thick bacillus with rounded ends resembling in form an oval coccus.

Stab and slant cultures were made on Löffler's blood serum, and bouillon cultures were also made. After twenty-four hours there was considerable development of gas in the blood serum stab culture, and cover-glass smears showed the same two bacilli, but the larger variety was relatively much more abundant. By Gram's method the larger bacilli stained deeply and showed numerous spores, about eight to twelve to each organism. The other bacilli were decolorized completely. There were no ordinary pus cocci present. Welch's acetic acid and gentian violet capsular stain showed the larger bacilli to be surrounded by a thick, transparent capsule, square at the ends. Examination in the hanging drop failed to show any motion in the larger bacilli. In bouillon and on slant cultures the large bacilli grew very scantily. The presence in the wound of this large anaërobic, capsulated, nonmotile, gas-producing bacillus, which stains by Gram's method and produces spores in blood serum cultures, leaves no doubt of its being the Ærogenes capsulatus of Welch.

The other bacillus was about two or three microns in length,

but varied greatly in size. They were extremely motile when examined in the hanging drop, resembling in appearance a culture of typhoid bacilli. They were decolorized by Gram's method and grew profusely on the ordinary culture media at room temperature in the summer and produced a very offensive odor. In bouillon the medium was rendered turbid, and a white sediment formed at the bottom. The individual bacteria were larger than those from the wound.

Colonies upon the blood serum streak cultures were opaque and sent out branches. They produced considerable water of condensation, and subsequently liquefied the medium. All of these peculiarities are characteristic of the Proteus vulgaris.

The Ærogenes capsulatus was first reported as the organism of emphysematous gangrene by Welch, of Johns Hopkins, in 1892, and since then a considerable number of cases have been observed, the majority of them being fatal. Welch found that when inoculated into mice the cultures varied greatly in virulence, and some were not pathogenic. In our case we either had a non-virulent culture or the free access of air after amputation prevented further growth of the organisms. They seemed to have produced no trouble after the first few days.

Regarding the Proteus vulgaris, the available literature is limited. The organism has long been known as one of the common bacteria of putrefaction, and produces several toxins, principally æthylendiamine and gadinine. There is some discussion as to whether the Proteus vulgaris is a true pathogenic organism or simply a stink-producing parasite, but there is considerable evidence to support the view that it is truly pathogenic.[1]

In looking over the " Surgical History of the War of the Rebellion," I was impressed with the great similarity of our case and those described and lithographed under the name of hospital gangrene. (Surgical, Vol. ii, pp. 739 and 928; Vol. iii, p. 823.)

[1] Since this case was first reported, a very able article by Dr. Martin W. Ware, on the Proteus vulgaris in surgery, has appeared in the July number of this Journal.

This disease was common in the Armies of Virginia and Tennessee, and was reported as being especially frequent in Sherman's army in Georgia. The disease was characterized by Acting Assistant Surgeon W. W. Keen as, "The typhus of wounds; a most unwelcomed guest to any hospital, and most of all a military hospital." When once introduced, the disease would go through a surgical ward, infecting nearly all the cases. At the hospital in Annapolis, for example, a few prisoners were brought in from Richmond with hospital gangrene, and in a few days sixty cases had developed. In the hospital at Louisville 343 cases occurred within a year. Acting Assistant Surgeon C. H. Cleveland describes the appearance of the disease as follows: "Hospital gangrene as it has been presented to us at the hospital assumes a great variety of appearances. In the early stages it has appeared as a dusky, almost black, mass of dead and rotten flesh occupying the seat of the disease, and surrounded by a reddish ring of slightly swollen integument, while the adjacent tissues do not appear to be affected. When a surface already divested of its skin is affected with the disease, the first invasion appears to give the surface an ashy gray color with pultaceous consistency and the peculiar odor of *spoiled meat* by which the disease is readily recognized. When the muscular tissue has become infected, and when small blood-vessels have become ruptured, a dark, grumous, almost black, dirty appearance of the diseased surfaces is presented and accompanied by a powerful fœtid odor, and usually with invasion of the disease under the skin."

Assistant Surgeon J. J. Woodward, who was sent to Annapolis to study the pathology of the disease, divides the cases into two classes. In the first class the sloughs form and extend without much swelling or involvement of the neighboring structures; and in the second class "the tissues about to be invaded are red, hard, and swollen, and made up of spherical granular cells quite identical with pus-cells."

Cleveland's description applies to all the important features of our case so accurately that there is no doubt of the identity of the two diseases. It belongs to Class I of Wood-

ward, and it is to be noted that the ordinary pus cocci were not present in the early days of the disease. Cases in Class II of Woodward were probably cases of mixed infection of the Proteus vulgaris and streptococcus.

This case, together with the report of many similar cases in this region during the Civil War, would suggest that the soil of Georgia may be peculiarly rich in pathogenic bacteria, and will well repay further investigation.

THE IMPLANTATION OF SILVER FILIGREE FOR THE CLOSURE OF LARGE HERNIAL APERTURES.[1]

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LARGE hernial apertures are frequently met with in surgery. They are always a source of more or less perplexity and concern to the surgeon called upon to relieve the condition. They occur as a result of long existing ruptures with atrophy of the adjacent muscular and fibrous tissues, but more frequently in consequence of previous surgical intervention (recurrent hernia, prolonged drainage, faulty asepsis, etc.).

In his efforts to close these large defects, it is the surgeon's aim to make use of the tissues as found in the patient himself, whenever possible. Thus, for instance, in the case of a large umbilical or ventral hernia of the linea alba, we split the sheath of the recti muscles, loosen their belly, move them towards the median line, and stitch them together by means of chromicized catgut, kangaroo tendon, or silver wire (Gersuny, *Centralblatt für Chirurgie,* 1893, No. 43); or, when dealing with an umbilical hernia, we can also make a plastic operation according to Piccoli (*Centralblatt für Chirurgie,* 1900, No. 2). In case of a wide gap in the abdominal wall in the appendix region, where the normal borders cannot be reunited, we utilize the outer half of the rectus muscle for

[1] Read before the American Surgical Association, Albany, June 3–5, 1902.

transplantation into the defect. As regards the treatment of large defects in inguinal and femoral herniæ, Trendelenburg was the first who successfully sutured a disk, taken from the head of a recently resected humerus, into the aperture (*Report of German Surgical Congress,* 1890, i, 133); later he modified his procedure by turning into the hole a pediculated periosteal bone flap that had been chiselled out of the patient's pelvis. The same procedure was recommended by Kraske and Körte (*Handbuch der praktischen Chirurgie,* Vol. iii, p. 645).

Although in possession of these various useful methods, we nevertheless occasionally encounter herniæ of such enormous dimensions that we know beforehand we cannot permanently cure them by any of the aforementioned procedures. Such cases have been hitherto considered incurable, and many surgeons, apprehending the negative result, have refused operation. Yet it is just this class of patients who most urgently request and need surgical help.

It is, therefore, gratifying to know that the implantation of silver filigree bids fair to fill this gap in our therapeutic resources.

Schede was the first to champion the use of silver wire in closing abdominal incisions with a view to preventing a subsequent hernia. His sutures embrace the entire thickness of the abdominal parietes exclusive of the skin. He has practised this method for many years, and has never since seen a ventral hernia occur after any of his abdominal operations where the wound could be thus closed (*Centralblatt für Chirurgie,* 1900, p. 257, foot-note).

The discovery of the strong antiseptic properties of silver, by Credé, gave a fresh impetus to the more extensive use of this material in operative surgery.

In 1900, O. Witzel, of Bonn, published his method for the closure of abdominal wounds and hernial apertures by means of buried silver-wire netting (*Centralblatt für Chirurgie,* 1900, pp. 257, 457, and 1149). He uses wire of different thicknesses, and aims to prevent the appearance of a

ventral hernia by arranging his sutures in various directions and layers across the opening, leaving the net-work of wire thus produced permanently in place. The ends of the suture are always twisted with the fingers, the cut ends being left about one centimetre long, and held down by the subsequent superficial wire sutures in such a way as not to give rise to future annoyance by pricking from within. For the cure of recurrent hernia after the failure of one of the radical methods now in general use (Bassini, Kocher), buried wire netting of larger dimensions is made use of. In these cases the peritoneal cavity is not opened if it can be avoided. First, the borders of the hernial opening, after proper exposure, are brought into closer proximity by means of interrupted wire sutures of medium size, which are made to cross one another, or by a continuous suture, as the case may require, without producing undue traction. A needle with a long piece of much finer silver wire is then plied transversely and obliquely across these sutures until a regular fine net-work has been formed. The peritoneum is included in these sutures whenever necessary in order to avoid dead spaces. Witzel thinks that the wire net-work should be at least three times the size of the hernial aperture. He states, "the farther the sutures are carried beyond the border lines of the opening the better will be the result," since pressure and constriction of the enclosed tissues will thus be less likely to be produced. As above stated, he forms the netting himself within the wound during the operation, and gives special directions as to how to proceed in the different varieties of hernia.

The publication by Witzel of his method of closing abdominal defects with silver-wire netting induced R. Göpel, of Leipzig (*Centralblatt für Chirurgie*, 1900, No. 17, p. 458), who had been working along similar lines for some time, to also make public the result of his own experience with the implantation of *ready-made* silver-wire netting as a means of closing hernial apertures, so that these two communications came to be published almost simultaneously.

Göpel's report covers a period of more than three years,

the first operation having been done in March, 1897. He points out the following advantages of the ready-made silver filigree over the self-made wire netting:

(1) The tissues bordering the hernial aperture are less exposed to injury and constriction;

(2) The time required for the operation is reduced;

(3) The meshes of the ready-made wire pad are of equal and regular dimensions; a diastasis, even of small size, is less often met with;

(4) The amount of silver wire left within the wound is reduced to a minimum.

In cases of umbilical and ventral hernia the shape of the net is round, oval, or quadrangular, with blunt corners; it is sutured upon the aponeurosis of the abdominal muscles bordering the aperture.

In inguinal hernia the net has the shape of an acute-angled triangle with the base turned towards the median line, where a small excision has been made for the spermatic cord. It rests on the internal oblique or transversalis muscle. The sides of the triangular wire pad are attached to Poupart's ligament below and the muscles above.

Göpel's report comprises eleven cases of umbilical and ventral hernia and seven cases of inguinal hernia in which the implantation of silver filigree, just referred to, was practised, with but two failures. In the latter the formation of a hæmatoma necessitated the removal of the netting. In some of the successful cases the hernia was the size of a child's head. The largest net implanted was 10½ by 17 centimetres (4 by 6¾ inches) in size. By taking proper care in securely fastening the borders of the wire pad, even patients of the working-class were not molested by the presence of the foreign body.

In the United States, A. M. Phelps, of New York, has worked in the same direction since 1892. On the basis of his experience with silver wire, he recently advocated the discarding of all absorbable suture material (chromicized catgut and kangaroo tendon), now so universally and successfully em-

ployed in our radical operations for hernia, in favor of silver wire (*New York Medical Record,* September 22, 1900). To forestall the possible relapse of a hernia, he promptly fortifies "the inguinal canal with a mattress of wire, stitching the muscular layers over it, entirely obliterating the inguinal canal, bringing the cord out underneath the skin, and cutting the aponeurosis of the muscles so as to prevent strangulation of the cord." The sutures are continuous, sometimes arranged in layers. Abdominal wounds he closes with silver wire and fortifies them. Since 1892, 216 cases of hernia have been thus treated; among these were forty-six relapses after Bassini's and fifty-one after other operations.

However, as the title indicates, the purpose of this paper is not to discuss the usual radical operation for hernia, but to deal with large defects in the abdominal wall that cannot be closed by any means other than heteroplasty.

After having personally employed Gersuny's method for a number of years to my entire satisfaction (ANNALS OF SURGERY, 1900, Vol. xxxi, pp. 746 and 747), and having also given the transplantation of the external half of the right rectus muscle a trial in a case of large rupture in the appendix region following drainage, a patient came under my care last summer in whom any kind of autoplasty was absolutely out of question. The history of the case is as follows:

CASE I.—Male, aged fifty-five years; butcher; was operated upon for strangulated hernia, March 17, 1898, by another surgeon. Wound was left open. He was discharged from the hospital after eleven weeks, with the wound healed and a beginning hernia. All forms of trusses being uncomfortable, the defect in the abdominal wall was left unprotected for several years, in spite of heavy bodily work. June, 1901, the pain became unbearable. Admitted to German Hospital with large ventral hernia; insisted upon operation; ready to take any chances.

Operation, June 13, 1901.—Circumcision of scar; peritoneum opened; careful dissection of manifold adherent intestinal coils. Poupart's ligament cannot be distinguished; seems missing. Enormous gap extending from border of atrophied and

unyielding abdominal muscles to horizontal part of pubic bone. I decided to try and close the opening with silver-wire netting. Eight to ten interrupted sutures of heavier wire are used for the deep layers; moderate tension is brought to bear upon these in order to bring the superior border line of the defect as closely as possible to the line of the pectineal fascia and periosteum of the pubic bone. These sutures are then interwoven in all directions by long, continuous sutures of silver wire of finer grade. The needle is passed up to a line fully one to one and one-half inches above the aperture. The beginning of a new thread is twisted to the end of the former one. The work is difficult on account of the immediate proximity of femoral and external iliac vessels, which appeared exposed for a distance of several inches. The vein, pulled outward by a blunt retractor, immediately adjoins the inner border of the netting. Suture of remaining shreds of fascia and of the skin by means of catgut without drainage completes the operation. Very little reaction. Primary union throughout. After a while a small sinus, discharging serum, forms at inner angle of scar. The same closes within about six weeks. For safety's sake, the patient is kept on his back for eight weeks. He is discharged on the 19th of August without a truss; result perfect. Ten days later, in spite of my advice to the contrary, he is back at his former heavy work; after two to three weeks the sinus reopens, discharging slightly. It is left undressed and patient continues his work.—First examination of patient after operation, November 18: Silver pad protects aperture nicely. At its upper, outer angle, near the anterior superior spine, a hernia of small dimensions is noticed, which is said to have appeared about four weeks ago when carrying a heavy piece of meat. It corresponds to the direction of the femoral vessels. Additional operation and attention to fistula advised. Seen again May 26, 1902: Condition about the same; fistula closes and reopens; no medical attendance. Patient states that he has been greatly benefited by the operation and is perfectly able to attend to his heavy work.[1]

[1] On June 7, when lifting a cake of ice from the wagon and carrying it into the store, the patient felt a sudden intense pain within the abdomen. He soon had to quit work; vomiting set in; passage of gas ceased. Two days later he was brought to the hospital in poor condition; operation was promptly performed. It was found that an incomplete intestinal obstruc-

CASE II.—Mrs. H. F., aged forty-three years. In 1894, vaginal hysterectomy was performed for myoma by one of New York's gynæcologists. Five weeks later, bilateral oophorectomy. After another month, extirpation of left kidney on account of ureterovaginal fistula. Soon after being out of bed, a ventral hernia appeared at the site of the median incision. Abdominal supporter badly borne; therefore radical operation for the cure of the hernia by a well-known surgeon of New York. (1898.) Good result. One year later, when carrying coal up the cellar-stairs, sudden reappearance of the hernia. Further operation refused by a number of surgeons. The patient was first seen by me in February, 1900. Very large, irreducible omento-intestinal hernia; aperture about midway between symphysis and umbilicus. Patient demands surgical help.

Operation, March 1, 1900.—Dissection of intestines and omentum difficult, as they are matted together by dense adhesions with the parietal peritoneum. Reduction in Trendelenburg's posture. Aperture is round, larger than palm of hand. Autoplasty out of question. In order to shut off the peritoneal cavity, the omentum is drawn down tautly and stitched to the parietal peritoneum near the border of the gap by means of numerous interrupted sutures of chromicized catgut. The parietal peritoneum is then closed by a continuous suture on top of the omentum. The remnants of superficial fascia and subcutaneous scar tissue are preserved and stitched together as well as is possible. Continuous suture of skin. Primary union throughout. After six weeks the patient is allowed to get up with abdominal supporter, and soon

tion, due to manifold old-standing adhesions between coils of the small intestine, had suddenly become complete; beginning peritonitis in the neighboring coils. The wire netting had no relation to the trouble. The patient died soon after the operation. Only a very limited and hurried post-mortem could be done, during which the netting was removed *in toto* with the surrounding tissues. It is seen that the internal and external tissues have grown through the interstices of the netting, the whole thus forming a solid wall of great strength. According to the report of the assistant who made the post-mortem, a few loops of intestine had made their way downward alongside the great vessels, but these were found not to be involved in the trouble.

Surely, the netting as such had served its purpose; it had enabled the patient, an absolute invalid before the operation, to resume his heavy work for months without wearing any kind of supporter or protection.

after is discharged.[1] She could rejoice once more over the cure effected, feeling, as she said, like a new-born person, and being well able to resume her former arduous occupation (general housework). However, her happiness was not to last long. In July, five months after the last operation, after a mistake in diet, followed by severe vomiting, she suddenly felt something give way at the hernial orifice. As shown by the conditions revealed at the later operation, the spasmodically contracting stomach had pulled the omentum off the right lower circumference of the hernial opening. When I saw the patient again in March, 1901, a large hernia had reappeared, causing her great annoyance. In this condition she was presented before the New York Surgical Society (ANNALS OF SURGERY, 1901, Vol. xxxiv, p. 572), with the statement that another attempt at a radical cure, with the help of silver-wire netting, was contemplated by me. This operation was done June 29, 1901, at the German Hospital: Longitudinal incision as before; excision of skin scar. Omentum has torn loose from right lower circumference of aperture. Intestines have pushed forward. Reduction in Trendelenburg's posture; omentum again stitched to border. That part of parietal peritoneum which formerly represented the hernial sac tears in many places and cannot be preserved. Then, after sufficient undermining of the subcutaneous fat layer, a ready-made silver filigree pad, six by four inches (Fig. 1) (which I procure through the Kny-Scheerer Company, of New York), thoroughly sterilized by boiling, is placed upon the defect. It rests upon the omentum and adjoining abdominal wall, where it is stitched to the underlying fascia by a continuous suture of heavy silver wire. After this the fat wound is closed by a few far-reaching, deep, and a great number of more superficial silkworm-gut sutures. There was no reaction. The upper portion of the wound healed by primary union. In the lower half localized fascia necrosis caused temporary suppuration. Nevertheless, the wound closed definitely after a while and has remained closed up to date. In view of her weight (250 pounds), it was thought best to keep the patient on her back for eight weeks. She then got up, requiring no support, the rupture having been radically cured. The wire pad, while palpable, caused

FIG. 1.

[1] Shortly afterwards she developed an epigastric hernia of small size, directly above the umbilicus, which also was successfully operated upon at the hospital.

FIGS. 2 and 3.—Showing result after implantation of silver filigree pad for relief of ventral hernia.

FIGS. 2 and 3.—Showing result after implantation of silver filigree pad for relief of ventral hernia.

the patient little discomfort. Only on and off she noticed some slightly painful sensation in the region of the scar. On returning home, she was obliged to immediately resume her former heavy work, which often severely taxed the firmness of the plate. The latter stood the test well, however, in always successfully resisting the increased intra-abdominal pressure.

In the early part of October, when washing dishes, standing in front of a low kitchen sink, she struck the region of the protected hernial opening against the corner of the sink. A sudden, intense pain almost made the woman faint. Yet no injury could be detected when I examined her a few days later. Developments since have shown, however, that she must have torn the continuous suture at the time of the accident, causing one of the corners of the well fastened filigree pad to come loose; for to-day I am able to palpate in the right lower circumference of the original rupture a slight omental protrusion. Nevertheless, the patient feels well and experiences little discomfort from this cause. Several attempts to demonstrate the position of the pad on a radiograph were unsatisfactory, probably on account of the patient's immense circumference. (Figs. 2 and 3.) It is my intention to reopen the scar and repair the defect by placing an additional netting *in situ* just as soon as this can be arranged. I confidently expect to see the patient, with a little bit of personal care, at last remain permanently in the same satisfactory condition that the former three attempts at a cure had always been successful in effecting temporarily.

In order to more securely guard patients against harm from such accidents as the one just described, I shall in future similar cases fasten the plate by a second continuous suture of wire.

CASE III.—Mrs. M. S., aged thirty-one years; nullipara. About a year ago first noticed a reducible, small tumor in the region of the umbilicus. For this she wore an abdominal supporter with a special pad. Within the last week the hernia had become irreducible, hard, and painful. When first seen by me, March 12, 1902, a tumor, the size of a cherry, was visible in the region of the umbilicus. It appeared to be an irreducible, inflamed, umbilical omental hernia. Ice and rest soon reduced the inflammation. Reduction, then feasible, showed the neck of the rupture to be about one-half to three-quarters of an inch to the left of the umbilicus, the contents of the sac causing the latter to

protrude considerably. In view of the annoyance attendant upon the wearing of a bandage, and the recent inflammation in all probability caused by the same, the patient readily agreed to have the proposed radical operation performed. On April 2, 1902, omphalectomy. It was seen that the hernia had been caused by a retraction of the left rectus muscle. Whereas the right rectus muscle immediately adjoined the median line, the left made a pronounced curve at a level with the umbilicus. In order to carry out Gersuny's operation, it would have been necessary to make an incision from the xiphoid process to the symphysis, with extensive dissection of the left rectus muscle; and this, in view of the large amount of adipose tissue (patient's weight being 190 pounds) and the tense, unyielding character of the patient's abdomen, did not seem advisable, especially as a satisfactory result seemed by no means insured by such procedure. I therefore decided upon the implantation of silver filigree. A pad, three and a half by four inches, was placed upon the aperture, which latter was as large as a silver dollar. Again the omentum was utilized to protect the intestines in the same manner as in the preceding case. Then the two skin fat flaps were reflected sufficiently to make room for the plate. A continuous wire suture was run around the border to hold the netting in place. Wound closed with silkworm-gut sutures; two minute rubber-tissue cigarette drains at either end. These were removed on the third day after the operation, when the wound was found to have healed by primary union throughout. At the end of the third week the patient was carried home, with instructions to remain on her back for another week. To-day she is entirely well, and so far not annoyed by the heteroplasty.

The foregoing three cases are sufficient, I think, to show that the class of herniæ, formerly considered inoperable on account of the size of the defect in the abdominal wall, are still amenable to treatment by the method just reported. In spite of great intra-abdominal pressure, this artificial, subcutaneous, or submuscular pad does not yield, firstly, because it is securely held in place by the silver-wire sutures, and, secondly, because the little lobules of fat are pressed through the meshes, and thus the scar tissue below and above becomes a unit with the neighboring tissues.

A most interesting and important feature of this kind of heteroplasty is the fact that it remains *in situ,* undisturbed, even though the wound should not heal aseptically, or suppuration, in consequence of a localized fascia necrosis, etc., should set in.

Witzel observed this fact and calls attention to it. Phelps emphasizes it, and, in the event of wound infection, advises "a small incision of the sinus, curetting of the infected portion, and filling of the wound with pure carbolic acid, which is afterwards washed out with alcohol."

My first case above reported also nicely illustrates this point. Evidently the antiseptic properties of silver are responsible for this phenomenon. It places this kind of heteroplasty in favorable contrast with other kinds, as, for example, celluloid, aluminum plates, etc. It represents one of the chief advantages of the method, and explains the success that has thus far attended its use in replacing a defect of the lower jaw (C. Hofmann, *Centralblatt für Chirurgie,* 1900, p. 1145); or in covering a defect in the trachea (Grosse, *Centralblatt für Chirurgie,* 1901, p. 1110); in replacing the diaphysis of the tibia, which had become entirely lost by necrosis (Hofmann, loc. cit.). In localities that can be rendered and kept sterile, it has proved of greatest value, thus, for instance, in covering a defect in the skull after trephining (A. Gleich, *Centralblatt für Chirurgie,* 1900, p. 412); in supporting a movable kidney (Witzel, *Centralblatt für Chirurgie,* 1900, p. 1149), etc.

There can be no doubt, I think, that the field of its usefulness will be widened as we gain further experience. I believe, for example, that it would prove of great value in cases where a certain area of the abdominal wall as such, including the parietal peritoneum, had to be excised on account of a tumor (fibroma, fibrosarcoma, etc.). In such cases, I think it would be wise, wherever this can be done, to first pull down and stitch to the border of the aperture the omentum—same as I have done it in two of my cases—in order to properly protect

the intestines against injury from the implanted foreign substance.

On reviewing the results that have been thus far obtained with silver wire and silver-wire filigree in closing large, otherwise intractable hernial apertures, it seems to me, we may well say, that this new style of heteroplasty deserves the earnest consideration of every surgeon.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, May 28, 1902.

The President, LUCIUS W. HOTCHKISS, in the Chair.

NEPHRECTOMY; EXTERNAL URETHROTOMY.

DR. GEORGE EMERSON BREWER presented a boy, aged twelve years, who had suffered from pain in the right side for two or three years. The pain was paroxysmal in character, coming on every two or three months, and was often accompanied by fever and rarely by nausea and vomiting. He was first admitted to the Roosevelt Hospital about two years ago, after the subsidence of one of these attacks. As the history strongly suggested a relapsing appendicitis, and as the only physical sign present was tenderness in the region of McBurney's point, an interval appendicectomy was done under chloroform anæsthesia. On examination the appendix was found to be free from marked evidences of disease. Further exploration in the neighborhood revealed nothing which would point to any other organ as the seat of the lesion. He made a good recovery, and was discharged from the hospital apparently cured. One year later he returned, again complaining of pain in the right side, this time referring its point of greatest intensity to the lumbar region. On examination, the right flank was found to be the seat of a large oblong tumor, somewhat sensitive to the touch and giving on deep palpation an indistinct sense of fluctuation. The temperature was normal. There was no muscular rigidity, the function of digestion was apparently unimpaired. Urination was normal and regular and unaccompanied by pain. Examination of the urine failed to reveal any evidence of disease. Under chloroform anæsthesia an oblique incision was made in the loin extending from the last rib to a point opposite the anterior superior spinous process of the ileum, and the tissues divided layer by layer until the peri-

neal fat was reached. The large tumor was found to be an enormously dilated kidney, which upon section was found to contain a slightly cloudy fluid with a decidedly urinous odor. The ureter was dilated to the size of the forefinger. The point of obstruction was found to be considerably below the brim of the pelvis. As the kidney tissue was to a great extent atrophied by prolonged pressure, and as the obstruction could not be moved after considerable manipulation with sounds, the kidney was extirpated after separate ligation of the vessels of the pedicle. The ureter was ligated at the brim of the pelvis, and its end thoroughly disinfected. The wound was closed by layer sutures, with one small cigarette drain emerging at the upper angle. Primary union occurred, and he was discharged from the hospital completely relieved three weeks after the operation. Five months after his discharge from the hospital he was readmitted, suffering from an acute retention of urine. On examination his bladder was found to be distended, reaching half-way to the umbilicus. Persistent effort resulted in the passage of only a few drops of bloody urine. Exploration of the urethra revealed the presence of a calculus impacted in the prostatic portion of the canal. Under chloroform anæsthesia a perineal incision was made on a grooved staff, posterior urethra dilated, and a calculus about the size of a bean removed. A No. 24 perineal tube was introduced into the bladder, the wound dressed, and the patient placed in bed. His recovery was uneventful. The tube was removed on the fourth day; the wound granulated rapidly, and closed at the end of two weeks. A No. 24 steel sound was passed to the bladder every third day at first, and later once a week. It is probable that the urethral calculus was the one originally situated in the lower part of the right ureter, giving rise to the hydronephrosis, and which had subsequent to the operation become loosened, dropped into the bladder, and become impacted in the posterior urethra.

Dr. Howard Lilienthal said that Dr. Brewer's case was a good illustration of the fact that it is in some instances a practical impossibility to differentiate between disease of the ureter and the appendix. In one such case which came under his observation the speaker said he was enabled, by unusual circumstances, to make a correct diagnosis. The case he had in mind was that of a man who had some genito-urinary trouble, for the

relief of which Dr. Lilienthal introduced a stylet into the right ureter as far up as the kidney. Then an attempt was made to pass a catheter over the stylet, but this was arrested at a point corresponding to the usual location of the appendix. The instruments were introduced without the use of an anæsthetic, and when the catheter became arrested, the patient complained of pain at the point indicated. Efforts to introduce it further were persisted in for some little time, but the attempt was finally abandoned and the patient was sent to bed. Following these manipulations, his temperature ran up to 103° F., and he complained of pain in the appendicular region; in addition to this there was a periureteritis, causing a tumor, and the entire clinical picture was typical of appendicitis, even to the nausea and rigidity of the rectus. The man refused an operation, and under the application of poultices his acute symptoms disappeared. His ureter, however, remained palpable for months afterwards, and even now, three years later, he occasionally has attacks of pain in the region of the appendix.

AMPUTATION AT THE HIP-JOINT.

Dr. Brewer presented a woman, aged twenty years, who was admitted to the surgical division of the Roosevelt Hospital in March, 1901. When four years of age, patient fell, injuring the left hip. Some months after this lameness appeared, and was later followed by deformity and an inability to use the limb. About a year later she underwent a course of treatment, which did not materially improve her condition, and later an excision of the joint was made. Following this operation there was a persistent sinus, for which she underwent considerable treatment. While she would remain in bed, the sinus would heal, and she would be free from pain. Whenever she got about on crutches, however, there would be a return of pain, evidences of inflammation in the neighborhood of the hip, and a re-establishment of the sinuses, which would continue to discharge until she again assumed the recumbent position. About two years ago she entered the Hospital for the Ruptured and Crippled, where her sinuses were thoroughly curetted. This treatment was followed by improvement at first. The sinuses closed and remained healed while the leg was kept at rest, but immediately reopened when she attempted to get about. Since that time they have continued to

discharge, and she has suffered more or less pain. She was first seen by the reporter at a home for incurables where she had been sent. On examination the left thigh was considerably atrophied and shortened. There were a number of sinuses in the region of the hip-joint which were actively discharging a thin, serous pus. The leg was fixed in a position of marked flexion, and any movements of the hip were accompanied by marked pain. As the leg was too short to be of any use in locomotion, as the condition of the joint precluded the possibility of her getting about without pain and increased suppuration, and as her general condition was beginning to deteriorate, an amputation at the hip-joint was advised.

Under chloroform anæsthesia, after thorough preparation of the leg and hip, Wyeth's pins were introduced and a rubber tourniquet applied. A circular incision was made about four inches below the joint, and was joined by a vertical one extending upward on the outer side of the leg to a point well above the acetabulum. The muscles were quickly divided and the bone dissected from the mass of fibrous tissue in which it was embedded. As the acetabulum presented no evidences of active disease, the wound was closed with gauze drainage and an aseptic dressing applied. At the close of the operation her condition was satisfactory, and no stimulation was ordered. The following day her temperature rose to 102° F. and pulse to 128. After that both gradually fell to the normal. First dressing on the eleventh day. The wound was found to be healed throughout. Subsequent history uneventful. She was discharged from the hospital at the end of four or five weeks, and has since gained rapidly in health.

Dr. Brewer presented also a second case similar to the one just reported. The patient was a woman, twenty-five years of age, who had suffered from hip disease since six years of age. At the age of seven she was admitted to the Brooklyn Hospital, where she underwent an operation for the relief of the deformity. Six years later she was readmitted to the same hospital, and submitted to a second operation for the removal of dead bone. One year later excision of the hip in the same institution, where she remained two years and seven months. Since the last operation she has never walked except with crutches. In 1896 she was admitted to the Presbyterian Hospital, where she was again oper-

ated on for the removal of dead bone. A year later she was admitted to a home for incurables, where she was seen by the writer.

Condition at the Time of Examination. — A pale, anæmic woman, practically bedridden, suffering more or less constant pain in the region of the hip. On examination the left thigh was found to be considerably shorter than the right and fixed in a position of acute flexion. The lower leg was of the same length, but showed marked muscular atrophy. The region of the hip was honeycombed with sinuses, several of which discharged large quantities of pus. The skin was very much infiltrated, and in places hot and tender; movement of the thigh gave rise to acute pain which continued for some time. Examination of the lungs was negative. The urine showed a trace of albumen, hyaline, and finely granular casts. Amputation at the hip-joint was advised, and readily accepted by the patient. She was accordingly transferred to the surgical division of Roosevelt Hospital, where in November last she submitted to an amputation at the hip-joint. After the usual preparation chloroform was administered, Wyeth's pins introduced, and a rubber tourniquet secured in place above the pins. It was necessary to make an atypical incision in order to secure for a flap the upper and inner skin of the thigh, which was the only tissue in the neighborhood unaffected by the disease. After division of the muscles, considerable difficulty was experienced in dissecting out the diseased head of the bone, which had become firmly united to the tissues in the neighborhood of the acetabulum. The acetabulum itself showed evidence of disease and was thoroughly curetted. Partial closure of the wound by silkworm-gut sutures after securing the vessel. There was practically no reaction following the operation. The temperature and pulse remained at or near the normal line. First dressing on the twelfth day, at which the abundant gauze drainage was removed. Second dressing ten days later, when the wound was found to be practically united. A small sinus developed later, from which a very minute seropurulent discharge at times exudes. She has gained considerably in weight and enjoys far better health than ever before.

Dr. Royal Whitman said that in cases of hip-joint disease like the two shown by Dr. Brewer, amputation was the only logical treatment. In some cases in younger subjects, when

excision had failed, amputation should follow as a life-saving operation. It is, however, rarely possible to get the consent of the parents for such a radical measure.

GENERAL PERITONITIS FROM UNKNOWN CAUSE.

Dr. Brewer presented a woman, aged twenty-three years, who was admitted to the Roosevelt Hospital on the fifteenth day of July, 1901, suffering from pain in the abdomen, accompanied by nausea and vomiting. She stated that the attack began three days before by persistent pain in the region of the epigastrium. Later she vomited a large amount of green fluid. The following day the pain increased, the vomiting continued, and there was evidently a considerable amount of fever. On entrance the pulse was rapid and weak, the temperature 103° F., tongue dry and covered with a brownish coat. The abdomen was greatly distended, tenderness and muscular rigidity were everywhere present. No tumor could be made out. As it was evident the patient was suffering from an extensive peritonitis, and as there were no physical signs to point to the origin of the inflammation other than the fact that the pain began and persistently remained in the region of the epigastrium, it was decided to perform a median laparotomy, and to be guided thereafter by the conditions which were found at the exploration.

Under chloroform anæsthesia an incision was made in the median line, extending from a point midway between the umbilicus and the ensiform downward for about four inches. On opening the peritoneal cavity a large amount of thin, watery pus was evacuated. The intestines were everywhere injected, and in places covered with a thick layer of lymph. Every part of the abdominal cavity contained pus in large quantities. A hasty examination of the stomach and duodenum was made, but no perforation found. The regions of the gall-bladder and appendix were also explored and found to be negative. The incision was then extended downward and the pelvic viscera explored, but without revealing the evidence of any inflammatory or septic focus. The lesser peritoneal sac was next opened by an incision through the transverse mesocolon and the posterior wall of the stomach and region of the pancreas inspected. As nothing was found to account for the peritonitis in these regions, the intestines were removed from the body, the entire abdominal cavity flushed with

a large amount of hot salt solution, and every portion of the alimentary canal thoroughly inspected. The only point which suggested the origin of the infection being a thickened area in the lower part of the ileum, which had the appearance of an inflamed Peyer's patch, and provoked a suspicion that the infection was typhoidal in character.

Although there was no evidence of perforation, the summit of this thickened area was turned in by means of a purse-string catgut suture, after which the intestines were returned to the abdominal cavity and the wound closed by interrupted through-and-through silkworm-gut sutures, a large cigarette drain being left in the upper angle of the wound. As her condition at the close of the operation was extremely critical, an intravenous infusion of about 2000 cubic centimetres of hot salt solution was made before she left the table. After her return to the ward her condition necessitated very vigorous stimulation for twenty-four or thirty-six hours. She suffered considerably from abdominal pain, and continued to vomit at intervals until the bowels freely moved on the fourth day, as the result of medication and copious enemata. The temperature immediately after operation was between 104° and 105° F., and for five days continued in that neighborhood, with occasional relief by cold sponge baths. During this period the tongue was dry and heavily coated, the mind somewhat cloudy, and the whole picture suggested typhoid fever. Repeated examinations of the blood, however, failed to give a positive Widal reaction, and there was never at any time any evidence of enlargement of the spleen. After the fifth day her symptoms began to improve, and she made a satisfactory recovery.

Dr. F. Kammerer said he had recently seen two cases of peritonitis in which he was unable to determine the cause. One of the patients was a girl of six years, with a well-marked general peritonitis which was supposed to be the result of appendicitis. Her condition was such that an operation was not deemed justifiable. She died a few days later, and, although a pathologist made a very careful post-mortem examination, he was not able to determine the cause of the peritonitis. The appendix was found to be normal, as were, apparently, all the other organs, including those in the pelvic region.

The other case was one of general peritonitis in a woman

of about thirty. This was also supposed to be of appendicular origin, but upon opening the abdomen the appendix was found to be normal. The abdomen was completely filled with pus, and, in searching for the cause of the trouble, it was necessary to eviscerate a large amount of the intestines. The cause of the peritonitis was not found. The patient recovered, and subsequently developed a subphrenic abscess, which was recently operated on.

DR. HOTCHKISS said he had operated in four cases of general peritonitis where the cause was not discovered at the time of operation. In the first, one of typical and undoubtedly general peritonitis, the appendix and uterine adnexa were normal; the patient, however, had been under treatment in the hospital for chronic diffuse nephritis, and no other cause was found for the peritonitis either at operation or autopsy. At another time he had operated upon two cases in rather quick succession, both of which presented the classical signs of extensive general peritonitis, on admission to the hospital; and both cases had appeared very ill. Laparotomy had been done in both. In the first case the peritoneal cavity was filled with serous fluid with flecks of fibrin. The appendix, the uterine adnexa, and gall-bladder were found to be normal; the stomach was not examined. The peritoneal cavity was washed out and the wound closed. Recovery ensued. The next case was a much severer type of peritonitis, as evidenced by the seropurulent fluid found. The appendix and adnexa were normal, but the stomach was not examined on account of patient's bad condition. This patient did very badly at first, and finally her wound was reopened and the abdominal cavity washed out repeatedly with salt solution. This case finally recovered. During the past winter a fourth case had presented itself, with symptoms of extensive peritonitis. Median laparotomy showed appendix and adnexa normal. The peritoneal cavity was filled with seropurulent fluid, and the omentum and mesentery were studded with small areas of fat necrosis. In this case an acute pancreatitis had been suspected as the cause of the peritonitis, although it was not possible to demonstrate this on account of the patient's bad condition. After excision of one or two areas of supposed fat necrosis from the omentum for microscopical examination, the abdomen was filled with hot saline solution after a rather thorough flushing, and the wound was closed.

This case had also recovered, and perhaps does not belong in this category at all, as the subsequent pain in the upper abdomen and back and other signs led him to the probable diagnosis of peritonitis from acute pancreatitis.

DR. BREWER said he was glad to hear of a case of recovery from general peritonitis in an adult after the abdomen had been opened a second time. The speaker said he had resorted to this a number of times, and had never yet seen a patient improved by it, excepting in one case, and that was a child.

FRACTURE OF THE SURGICAL NECK OF THE HUMERUS.

DR. ROYAL WHITMAN presented a little girl who first came under his observation about two weeks after she had sustained a fracture of the surgical neck of the right humerus. As the fragments had evidently united in a false position, an X-ray picture was taken, and with this as a guide the broken ends of the bone were readjusted. In order to keep them in apposition, the arm was raised to complete abduction; the forearm was then flexed to a right angle, and the chest and extremity included in a plaster bandage, while traction was exerted on the arm. The final result was perfect.

FAILURE OF DEVELOPMENT OF THE RIGHT UPPER EXTREMITY, AND ABSENCE OF THE CORRESPONDING BREAST AND PECTORAL MUSCLES.

DR. WHITMAN showed a little girl with a marked congenital deformity. This consisted of a lack of development of the right upper extremity, together with absence of the lower half of the right pectoral muscles and of the breast and nipple on that side.

RESECTION OF ELBOW FOR TUBERCULAR ARTHRITIS.

DR. B. FARQUHAR CURTIS presented a woman, thirty years of age, who was operated on by him on November 20, 1899, for a tubercular arthritis of the right elbow which had existed for a year or more. There was a considerable amount of swelling about the joint, with limitation of motion and sinus formation.

The joint was resected in the usual manner. A considerable portion of the bones was removed in order to get a movable elbow, although they were not involved in the tuberculous process. The wound healed by primary union; but shortly after the operation there was considerable pain, and a rather stiff elbow resulted. Since then, however, it has developed into a very useful joint. The patient now has the power of full extension and right rotation, and when the limb is in the extended position there is no lateral movement whatever.

The reproduction of the joint in this case, Dr. Curtis said, has been fairly good. In doing the operation, he placed the stumps of the bones of the forearm underneath the end of the humerus, so as to duplicate, as closely as possible, the mechanism of the normal elbow. The patient has still very little power in the arm, but she is able to use it for light work. There is a curious grating sound in the elbow when the joint is moved. There is a small superficial ulceration of the skin, but there is no sign of recurrence in the joint.

Dr. Curtis said that in his opinion resection is the proper treatment for tuberculosis of the elbow-joint in adults, but he avoided the operation in children. In order to get a good result, it is necessary that the after-treatment should be very carefully carried out. Passive and active motion should be begun at the end of the second week if the wound has healed, or even if a slight sinus remains .

Dr. Curtis said he thought typical resections gave the best results in adults. In children he does as little as possible, usually limiting himself to the curette. In the motions resorted to after resection, the speaker said he was very careful to limit himself to the up and down hinge movements, and not allow any lateral movements. The motion should be limited to one plane by the use of a splint with lateral joints.

Dr. Lilienthal said he thought a good way to get early motion in these cases was to put a collar of plaster-of-Paris around the upper arm and another around the lower arm, and incorporate in the plaster strips of steel; then, by means of an ordinary thumb-screw attachment, the position of the arm can be changed to any desired angle.

Dr. F. Kammerer said there was a time when surgeons thought that the ideal treatment of these cases was to aim at

securing ankylosis in a position of flexion a little less than a right angle. The arm in that position is certainly preferable to a flail-joint, which can occasionally result after removal of much bone when a movable joint is desired. We are now agreed, however, that it is much better to get a movable joint. In order to obtain this, early movement of the joint is necessary, but this should be limited to one plane. Dr. Kammerer said that in the treatment of these cases he always employs an apparatus similar to that described by Dr. Lilienthal.

Dr. Kammerer said he was rather surprised that Volkmann's supinating splint was not used more than it is in our country. It is a very simple apparatus, keeps the hand in a position of supination, and with a joint below the elbow permits of passive motion in one plane.

A NEW METHOD OF TREATMENT FOR FRACTURE OF THE NECK OF THE FEMUR, TOGETHER WITH REMARKS ON THE CAUSES AND TREATMENT OF COXA VARA.

Dr. Royal Whitman read a paper with the above title, for which see page 746.

Dr. Curtis said he thought the method of treatment described by Dr. Whitman was a very practical one in dealing with this class of fractures in children, and that it would obviate the usual deformities following the injury in these cases. The speaker said he would hesitate, however, to try the same method in the adult, or at any rate in old people, in whom, he was inclined to agree with the text-books, these fractures are most commonly observed. He has occasionally seen a fracture of the femur during middle life, but the accident is certainly not common at that age. That the condition is not always recognized, even by competent men, the following case illustrates. A man, forty years old, sustained a severe injury to his hip. He was not totally disabled, but could not rest his weight on the leg. He was taken to a hospital, where he remained for three weeks, and was then able to walk home. Almost three months later he entered Bellevue Hospital, complaining of pain in the injured hip, with very decided limitation of motion. There was shortening and a little thickening about the neck of the femur. The case was first regarded as one

of possible tuberculosis of the joint, but upon applying the X-rays, a distinct fracture through the base of the neck was made out. The fracture was evidently an impacted one. Under massage and hot-air baths, motion was rapidly improving and the pain was less.

DR. WHITMAN said he did not advocate the method he had described for all cases of fracture of the neck of the femur; for example, he did not advocate it in old persons, or fat persons, or those with peculiar displacements. The speaker said he was inclined to believe there was no form of fracture in which the results of routine treatment are as unsatisfactory as in fracture of the neck of the femur. In old people, when the head of the bone is broken off and rotated, it is doubtful whether union could be attained under any circumstances. Dr. Whitman said he did not wish to contend that fracture of the neck of the femur is not very much more common in old people than in young people; he only wished to combat the statement that it is uncommon in those who are not old. In the latter class of patients the fracture is often incomplete; therefore the diagnosis is not often made. The method of treatment he had described was still in a somewhat experimental stage, but it was certainly preferable to no treatment whatever. In any event, the results were not likely to be worse than those attained under the present methods in any class of fracture of the neck of the femur, while in incomplete fracture it must produce far better ones.

INDEX TO SURGICAL PROGRESS.

GENERAL SURGERY.

I. The Use in Surgery of Solutions of Sodium Chloride with Sodium Carbonate. By E. TAVEL. In 1889, Buchner showed that the addition of distilled water to the body juices very quickly lowered their bactericidal powers, but that if normal salt solution was used instead of the distilled water no such lowering took place. Struck by this observation, the author suggested to Kocher that salt solution ought to replace sterile water as an irrigating fluid.

In 1890, v. Fodor proved that the absorption of certain substances into the blood greatly modified its bactericidal power. The absorption of hydrochloric or tartaric acid leaves the bactericidal power unchanged or diminished; the absorption of salt or of soda increases it considerably. Fodor concluded that the bactericidal power of the blood was due to its alkalinity. His best results were obtained with carbonate of soda, which increased the bactericidal power from 23 to 70 per cent.

Tavel formulates and studies the following proposition: "Would it not be logical to use for irrigation of wounds a fluid containing not merely the normal supply of salt, but one having the normal alkalinity of the blood, viz., 2 to 2½ per cent.?"

Asepsis and antisepsis have a common aim, viz., to secure the least possible contamination of the wound. The aim of the surgeon must be to contaminate the wound as little as possible, to preserve the histologic and physiologic integrity of the tissues, so that they, by agents at their disposal (phagocytes and serum), may destroy the few microbes which inevitably enter the wound during an operation.

The conservation of the bactericidal agents of the body (or perhaps their exaltation) has been sought by making use of "dry asepsis," "moist asepsis," rapidity in operating. When antiseptic solutions are employed, their value depends on the stimulation of phagocytosis and leucocytosis. Rapidity of operation is of importance, but is not applicable in all cases or by all surgeons.

Dry Asepsis.—Walthard, experimenting under the author's direction, found that mere exposure of the abdominal contents to the air produced changes in the peritoneum which led to the formation of adhesions, while, if the abdominal contents were protected from the air by compresses kept moist with saline-soda solution, no such adhesions formed. Wagner has noticed fatty degeneration of the superficial cells of the peritoneum in rabbits after the injection of air into the peritoneal cavity. Delbét has described necrotic changes in the endothelium following exposure to the air. Walthard continued his experiments in Horsley's laboratory, endeavoring to ascertain if the ill effect of air was due to the chemical action of its oxygen or desiccation. A current of filtered air passed through the peritoneum produced the same effects already noted (adhesions). Currents of oxygen, of carbonic dioxide of nitrogen passed through the cavity as a moist vapor produced no adhesions. He concluded that superficial desiccation produced by the air is the cause of the above mentioned peritoneal lesions. These experiments, never contradicted, but frequently confirmed by clinical experience, show "dry asepsis" to be not without drawbacks.

Moist Asepsis.—Walthard's researches show "moist" to be better than "dry" asepsis. It remains to discover the best solution, one which will be innocuous to the tissues, and at the same time favor phagocytosis, be capable of preservation a certain time without altering and without acting as a culture ground for microbes which may accidentally enter it, and which will serve for the sterilization of compresses, tampons, etc.

Tavel believes that he has found such an ideal material in

his solution of salt and soda. Experiment shows that the salt-soda solution, whether warm or cold, may be kept for a long time without becoming infected, and that any bacteria which may be accidentally introduced into it perish after the lapse of a short time.

When injected subcutaneously or into a vein, salt-soda solution has a marked ability to produce leucocytosis, as the following table shows:

Intravenous injection, 7 cubic centimetres solution, increased leucocytes 3 times; duration, 7 days.

Intravenous injection, 2 cubic centimetres solution, increased leucocytes 1½ times; duration, 1 day.

Intravenous injection, 2 cubic centimetres solution, increased leucocytes 1¾ times; duration, 3 days.

Intravenous injection, 8 cubic centimetres solution, increased leucocytes 1¼ times; duration, 2 days.

The author makes the following claims for his solution: "It is preferable to ordinary water for the sterilization of dressings; it remains sterile for a long time; prevents the formation of adhesions, does not irritate the tissues, provokes marked leucocytosis, has positive chemiotactic action, and excites the bactericidal functions of the organism without injuring the tissues as do antiseptics."

Preparation of salt-soda solution. The strength of the solution is, NaCl. 7½ $^{0}/_{00}$ + Na_2CO_3 2½ $^{0}/_{00}$. When made with distilled water, the solution is at first clear, but by the next day there is a slight deposit. When hot or boiled water is used there is a flocculent precipitate, which sinks rapidly; hydrant water gives a still greater precipitate, making the solution opalescent for twenty-four hours.—*Revue de Chirurgie,* May, 1902, p. 578.

I. Heart Surgery. By B. Merrill Ricketts, M.D. (Cin-

THORAX AND ABDOMEN.

I. Heart Surgery. By B. Merrill Ricketts, M.D. (Cincinnati). Experimental physiology and surgery show what can be done in heart surgery. Twenty-five dogs were used in experi-

mentations; penetrating and non-penetrating wounds of the heart were made and closed with sutures of different material. Interrupted silk sutures were found to be the best. No especial aseptic precautions were taken, as all pathologic conditions were desired. The author found that the pericardium could be entirely removed without death resulting. Either one of the coronary arteries could be ligated at its base without producing death. In a certain class of cases he concludes that it is best to suture the pericardium to the chest wall that drainage may be perfect. It is ideal to suture during systole, but one will be satisfied to secure perfect suturing in systole or diastole. Even though the auricular is thinner than the ventricular wall, it may be sutured with equal success. Owing to this difference in thickness, the per cent. of penetrating wounds of the auricles is much greater than those of the ventricles.

The author is of opinion that the application of surgical principles in certain cases of aneurism of the heart will, no doubt, in the near future be accomplished by suture, electrolysis, or the injection of gelatin or something of a similar character. The removal of a certain class of foreign bodies, whether they have formed within or have entered from without, should, and no doubt will, be accomplished.

That a cardiac abscess should be incised and drained, he thinks, there can be no doubt. Tumors of a pedunculated character on the external surface of the heart can and should be removed. Pedunculated tumors within the cardiac chambers can also be successfully removed. Parasitic cysts (animal or vegetable) when upon the external surface of the heart or in its wall should be incised and drained. Mitral stenosis, hypertrophy, and dilatation of the heart will sooner or later find complete or partial relief within the domain of surgery.

Lacerated or incised, penetrating and non-penetrating wounds of the heart should be sutured. Suturing or any other surgical procedure should not be discontinued because the heart should

cease to pulsate. The work can and should be completed within a much shorter time on a quiescent heart. All means should be resorted to, while the suturing of the myocardium is being completed, to re-establish the heart's action.

Drainage of the pericardial sac is necessary in many cases of injury of the heart. Exploratory incision of the pericardial cavity and its contents has been shown by both experimental research and operations upon the living human body to be exceedingly rational, valuable, and justifiable.—AUTHOR'S ABSTRACT.

II. Observations on the Sensibility of the Abdominal Cavity. By PROFESSOR K. G. LENNANDER (Upsala). It was with the idea of investigating in how far the various portions of the peritoneum, parietal and visceral, are sensitive, and their varying degrees of sensitiveness towards different stimuli, that Professor K. G. Lennander undertook the subject in hand.

He gives a minute description of thirty cases in which he has used local anæsthesia, and in which he has had exact record taken of every operative procedure, and also the relation it had to the sensation it caused in the patient. The method used was generally as follows: One-half to three-quarters of an hour before beginning local anæsthesia, ¾-1 centigramme of morphia subcutaneously was administered; this was sometimes repeated. Then, shortly before beginning operation, 1 milligramme of strychnine (0.01 : 10 aqua dest.) and 2 grammes of camphor oil (1 : 4) were administered. This prophylactic stimulation of the heart just before operation he has used for six years, since he considers it of great benefit in weak patients or where the operation promises to be protracted.

A stenographer took down every step of the operation with notes on the sense perceptions of the patient. To obtain uniform estimation of the degrees of pain, three columns of observations are given, which are designated as "slight pain," *i.e.*, barely perceptible to patient; "pain," *i.e.*, when it was of unmistakable

intensity; "great pain," *i.e.*, when patient was given the choice to decide as to whether to go on with local anæsthesia or to take complete narcosis. The results were also interesting in showing the effects of referred pain, since the patient could not always locate the exact seat of pain unless it was very severe, nor bring it into association with provoking agent of pain.

The cases are divided into groups that illustrate the relative sensitiveness of (1) the parietal peritoneum and great omentum; (2) the parietal peritoneum and gall-bladder, liver, and adhesion between abdominal organs; (3) parietal peritoneum and ileum and diverticulum Meckelii; (4) vermiform appendix, cæcum, and lowest part of ileum; (5) uterus and adnexa; (6) stomach.

In relation to the small intestine and mesentery, the following observations were made:

(1) When several loops of intestine protruded through the abdominal opening, the patient experienced no sensation of disturbed location nor of pain.

(2) Firm pressure of the small intestine between thumb and forefinger produced not the slightest pain nor sensation *when the mesentery was not drawn on.*

(3) Firm pressure on the intestine between thumb and forefinger in two places and stretching the portion of gut lying between them caused no pain or sensation when the mesentery was not pulled.

(4) Pressure of the mesentery between the fingers without pulling on it caused no sensation nor pain.

(5) Tension on the mesentery between the fingers at two fixed points, without pulling on the posterior portion attached to the posterior abdominal wall, caused no pain or sensation.

(6) Slight tension on the mesentery directly forward caused pain that was referred to the region of the umbilicus.

Parietal peritoneum. Light palpation of the parietal peritoneum produced pain, which increased by stronger palpation, and this was correctly referred to the side on which the palpa-

tion was made. The pain also was produced even when the edges of the wound were not touched. Sponges and tampons could be introduced and withdrawn from the abdominal cavity without causing pain when care was taken not to touch the parietal peritoneum.

Removal of a Meckel's diverticulum and of the appendix caused no pain when cut, nor did the stumps when treated with chemical (silver nitrate stick) nor thermal (actual cautery) irritants.

Lennander's view of McBurney's point is also interesting. He says that he considers it to be the point where the lymph vessels of the appendix go over into the parietal peritoneum in the posterior portion of the abdominal cavity, and that the pain is produced by a local lymphangitis and lymphadenitis at this point. The *sub*serosa at this point on the posterior abdominal wall with its innumerable nerves becomes inflamed.

Tubercular peritonitis. In a case of tubercular peritonitis, the same reactions were found as in the healthy peritoneum in regard to pain and sense perception.

Liver and gall-bladder. The surface of the liver was found to be like the intestines, void of sensation, also the gall-bladder peritoneum. However, when the gall-bladder was sewn to the parietal peritoneum or was adherent, pain was produced through irritation of the latter.

Ovaries and uterus. In a laparatomy the ovaries and uterus were found to be void of pain when touched by the thermocautery. Pulling or tension on them, however, produced pain.

Literature.—In addition to his own observations, Lennander goes at length into a critical review, with abstracts, of the principal literature bearing on the subject, and gives numerous references all through the paper. He gives some interesting physiological observations from Weber, and also from Haller.

Toilet of the abdomen. Washing out the abdominal cavity with normal salt solution at 42° C. he says was not an unpleasant sensation to the patient.

Conclusion.—The parietal peritoneum is very sensitive to all operative procedures; but the intestinal canal, anterior border of the liver, gall-bladder, great omentum and serosa of the urinary bladder, and the parenchyma of the kidney are entirely non-sensitive for all operative procedures.—*Mittheilungen aus den Grenzgebieten der Medizin und Chirurgie,* Band x, Heft 1 and 2, pp. 38-104.

WILLIAM F. JELKE (Cleveland).

III. Infection of the Lymph Glands in Carcinoma of the Pyloric Portion of the Stomach. By DR. LENGEMANN (Breslau). This paper consists in

(1) A review of the small amount of work that has been done heretofore on the pathology of the lymph glands in this region.

(2) A short chapter on the anatomy and direction of the lymph streams from the three chief divisions of the stomach, *i.e.,* cardia, fundus, and pylorus.

(3) A summary of the pathological findings in each of the twenty cases from von Mikulicz clinic.

(4) A list of the literature bearing on the subject.

Since Heidenhain's work on the carcinoma metastases found in the axillary lymph glands secondary to amputatio mammæ and Wertheim's studies in the metastases occurring in connection with carcinoma uteri, great interest has been manifested in this means of spreading of cancer and its relations to recurrence. Borrmann, of this same clinic, says in his work on "The Growth and Methods of Spreading of Carcimona in the Walls of the Stomach," "Since we may assume that within the stomach walls the growth and spread of the tumor mass occur by direct continual infiltrating strands which infiltrate by fine processes along the line of the lymph channels into the muscle, subserosa, and finally reach the omentum, then the metastases into the lymph glands which are principally situated in the omentum are by direct continual growth."

The findings in sections cut from 189 lymph glands obtained in twenty cases of carcinoma of the stomach showed seventy-nine with metastases, 110 free from cancer, or 42 and 58 per cent. respectively. The course of the lymph streams from the stomach follows, in general, the three principal blood supplies to that organ, and hence most of the lymph glands are found in the bend of the lesser curvature. The glands situated in this region showed the greatest tendency to the formation of metastases. Also, in cases where *ulcer of the stomach* simulated a carcinomatous appearance, and in some of these the macroscopical appearance of the two is very similar, a study of the lymph glands aided in forming a diagnosis and prognosis by distinguishing the two.

Dr. Lengemann strongly recommends the radical removal of all carcinomatous glands, together with the portion of the pyloric end removed in one piece, by removing the uniting portion of omentum in all cases of carcinoma of the stomach, when the condition of the patient will permit.—*Archiv für klinische Chirurgie,* Band lxviii, Heft 2, pp. 382-418.

WILLIAM F. JELKE (Cleveland).

GENITO-URINARY ORGANS.

I. Use of Adrenalin as a Local Hæmostatic in Urethral and Bladder Operations. By PROFESSOR DR. A. VON FISCH. In cases of vesical hæmaturia in which the preliminary irrigations always cause a renewal of the hæmorrhage, and thus prevent cystoscopy, the author has filled the bladder with 100 to 150 cubic centimetres of a solution of adrenalin, 1 : 10,000, leaving the liquid three to four minutes in the bladder, and only then beginning the irrigations. By taking this precaution, all hæmorrhage was avoided, or else it was so slight that the clearing up of the contents of the bladder was readily effected and the cystoscopic examination could be executed with perfect success.

In operating on tumors of the bladder, after opening the bladder above the pubis, several applications of the adrenalin solution,

1 : 1000, are made to the tumors and their immediate neighborhood, using a cotton pledget for the purpose. It will render possible the extirpation of the tumor in the blanched tissue almost without any loss of blood whatever. In this way the thorough removal of the base of the tumors is assured, and there is less danger of leaving behind, when dealing with multiple papillomata, a little of the oft minute new formations. Inasmuch as the anæmia of the mucous membrane persists for a comparatively short time, and the contraction of the vessels seems to be followed by their not inconsiderable dilatation, it is to be recommended, if one does not wish to stitch up the incision in the mucous membrane, that the wound be carefully packed, and the bladder also tamponed, in order to avoid secondary hæmorrhage. For the endoscopic removal of papillomata of the bladder, it is sufficient to fill the bladder with adrenalin solution, 1 : 10,000, as in the performance of cystoscopy.

In very narrow strictures which are difficult to enter, the application of a few drops of adrenalin, 1 : 1000, at the entrance to the stricture suffices so to reduce the swelling of the mucosa as to materially facilitate the introduction of the sound.

In the difficult catheterism of hypertrophied prostates, a preliminary instillation of 1 to 2 cubic centimetres of adrenalin, 1 : 1000, into the prostatic urethra is of great advantage. The introduction of the catheter is more readily performed and usually without bleeding, even when the prostate gland is congested. The preparation used by von Fisch is a solution containing adrenalin chloride, 0.1; sodium chloride, 0.7; chloretone, 0.5; distilled water, 100.0.—*Wiener klinische Wochenschrift*, 1902, No. 31.

II. Observations on the Functioning of the Ureters and Kidneys as a Means of Surgical Diagnosis. By Dr. Frederick Straus (Frankfurt am Main). The method introduced by Korányi for the estimation of the osmotic pressure of the blood and urine by determining the depression of their freezing points seems

destined to give us additional security in performing nephrectomy. It marks the limits within which the surgeon may be permitted to remove a diseased kidney. In the investigations concerning the functioning of a single kidney, the excretion of each organ must be obtained separately, *i.e.*, by separate catheterization of each ureter. The author has made more than fifty-five catheterizations of each ureter, the products of which have been separately analyzed. The analysis consisted in the estimation of urea, phosphoric acid, and chlorides quantitatively; also of glucose obtained by administering phloridzin, and the determination of the molecular density obtained by observing the lowering of the freezing point.

Physiologically active kidneys excrete through their appropriate ureters their urine at regular intervals, which alternate in action with each other. The intervals between the several discharges from the same ureter can vary within broad limits. They depend upon the concentration of the urine. In a concentrated urine the pauses may be as long as five minutes. The thinner the urine the shorter the periods. If the urine is very watery, the successive contractions of the ureters follow one another rapidly. They may diminish to intervals of four seconds. The total volume, however, of the excreted fluid undergoes no marked changes.

The quantity of fluid escaping at each contraction of the ureters fluctuates in the majority of cases between two-tenths to four-tenths centimetre. The volume of urine in the separate spurts remains the same, only the ureter contractions become more or less frequent.

If a catheter is introduced into the ureter, and the ureteral orifice (or lips of the valve) is watched at the same time through a cystoscope, it will be seen that immediately the contractions of the ureters and correspondingly the periods of excretion from the ureters follow more rapidly one another. The stiff catheter, however, offers a certain resistance to the peristalsis of the ureters, and the contractions become less frequent. This is least notice-

able if the catheter lies only a little way up the ureter, but, as it proceeds farther up, the slowing of the contractions becomes more obvious.

By advancing still higher an increased rapidity in excretion again appears the nearer the catheter approaches the pelvis of the kidney, until finally, as the eyelet of the catheter enters the pelvis, a continuous flow is set up.

The periodic spurts occur under strong pressure. From the contracting ureter the urine enters the bladder in whorls of diffusion currents, while from the introduced catheters it issues in drops. In the case of a diseased kidney, we see marked deflection from this type. In general, there is a slowing of the contractions of the ureters, which in number fall far behind those of the healthy kidney. This phenomenon appears especially marked in advanced unilateral pyonephrosis and tumors of the kidney.

If we compare, also, the volume of urine excreted from both kidneys, we will see that one within a short time excretes a large amount of fluid. If the other kidney is the seat of a tumor, or is in great part necrosed or tuberculous, or if a stone fills the pelvis, it excretes during the same time only a few cubic centimetres, or none at all.

Through the work of Casper and Richter finer relations in the functioning of the two kidneys have been obtained. They maintain that normal kidneys excrete the same amount of nitrogen and chlorine, and also the amount of sugar excreted following administration of phloridzin and the molecular density are the same. As the result of experimenting in twenty-two cases, the author substantiates these claims.

A diseased kidney does not work the same, but excretes in equal periods products that in relation to their contents of nitrogen, chlorine, sugar after phloridzin, and molecular density differ markedly. The pathologically functioning kidney produces not so great a molecular density as the sister organ, but holds back more molecules; it has a less molecular density. It excretes

accordingly less chlorine, less nitrogen, and produces less sugar from phloridzin. According to the kind and quantity of the sugar eliminated, especially, we have an important criterion in connection with the functioning of the ureters by which to make an estimation of how much functioning renal epithelium remains.

The following are the conclusions reached by the author as the result of his observations:

(1) The functioning of physiologically active kidneys is always the same in comparing right with left kidney. This functioning is, however, a changing one, indeed, at every moment in one and the same kidney.

(2) The functioning of pathologically working kidneys always shows, comparing left with right kidney, differences, and is in one and the same kidney at each moment a changing one and is never constant.

(3) Molecular concentration, chlorine, urea, phosphoric acid, as also phloridzin sugar in the urine, change from moment to moment in physiological as well as in pathological kidneys, but in the former case the opposite kidney corresponds, while in the latter (pathological) there is always a difference.

(4) The taking of fluids has an especial influence upon the osmotic pressure. A difference of 200 per cent. and more by this method can be obtained.

(5) There is always a gradual change in concentration in direct relation to digestion and resorption processes. The concentration sinks gradually with diminution of digestion and resorption.

(6) We cannot fix a definite point for the freezing of urine above or below which we may definitely say a urine is pathological. It is easy, by means of adding fluid to the urine, to change or prevent the freezing point at will. A short time after the taking of fluids, the influence of such on the urine is shown by a sinking of the freezing point; for the smaller the numerical molecular value per unit volume, the lower will be the freezing point.

The ratio of the freezing point in the *total* urine is only of value in consideration with the total consumption and excretion of fluids and in relation to metabolism experiments. On the estimation of chlorides, however, exact conclusions may be based. Under the influence of drinking fluids and the consequent dilution of the urine, a change *on one side only* is an indication of the functional decline of that kidney; this change manifests itself at a time earlier than the ordinary tests of the functional activity of the kidney fail, so that this change, after the consumption of fluids, is an indication of a latent functionally weak organ.—*Münchener medicinische Wochenschrift*, 1902, July 22, pp. 1217.

WILLIAM F. JELKE (Cleveland).

REVIEWS OF BOOKS.

A Manual of Surgical Treatment. By W. Watson Cheyne and F. F. Burghard. In seven volumes. Lea Brothers & Co., Vols. iv, v, and vi.

The earlier volumes have already been reviewed in the Annals of Surgery. Vol. iv discusses the treatment of the surgical affections of the joints (including excisions) and the spine. Chapters i to ix treat of dislocations, x and xi of sprains and wounds. Section II describes the diseases of the joints, giving first a general consideration of inflammatory affections, tuberculosis, syphilis, nervous affections, rheumatoid arthritis, loose bodies, and ankylosis. Then follows a series of chapters on the affections of the individual joints. The last five chapters take up the consideration of the surgical affections of the spine.

This volume is full of the soundest writing, and will undoubtedly prove of the greatest value to the class of practitioners for whose use this work is destined. A particularly admirable feature is the very exhaustive description of the technical minutiæ of various plans of treatment, the reader being told not only what to do, but also just how to do it.

In the section on the spine, some parts do not seem to be so finished as the earlier chapters of this volume. The pathology of spina bifida is poorly and meagrely expounded. Hæmatomyelia is also imperfectly described, especially its symptomatology.

In Vol. v, the surgical affections of the head and face are presented. The first seven chapters describe the affections of the scalp and skull. Fractures and their sequelæ are passed over rather hurriedly, and we note a very imperfect description of th

mechanism of fracture of the base. The methods for localizing the middle meningeal branches should receive fuller consideration.

The seven chapters on the face are not particularly attractive, and many of the descriptions of operative measures suffer from the imperfect illustrations characteristic of the entire work.

The affections of the jaws take five chapters. The second half of this volume, written by H. Lambert Lach, treats of the intrinsic diseases of the nose, ear, and larynx, and is most valuable, especially the sections on suppuration of the accessory sinuses and the treatment of mastoiditis.

Vol. vi is devoted to the surgical affections of the tongue and floor of the mouth, the pharynx, œsophagus, and neck, the surgical affections of the abdomen. This is a most interesting volume. In the first portion, among many other valuable features, may be mentioned the section on malignant disease of the tongue, an admirable and thorough piece of work. Another particularly satisfying item is the section on tubercular glands of the neck, and the operative technique for their relief.

The pathology of the thyroid gland is insufficiently demonstrated, but the treatment is very well described. In the second part a chapter is assigned to the affections of the abdominal wall and four to the stomach. Some minor objections must necessarily be in order, such as the recommendation for suturing the abdominal wall with non-removable and non-absorbable suture material. Also to lengthy descriptions of now obsolete methods of gastrostomy. As a whole, the subject is admirably treated, especially the operative technique. The succeeding chapters on the affections of the intestine are not so thoroughly or systematically written. This criticism applies particularly to the subject of intestinal obstruction, which is weak in symptomatology, especially of the individual forms.

The section on appendicitis is on the whole satisfactory. There is some tendency to hang back, so to speak, as one may

judge. "The debatable (*sic*) question at the present time is whether the appendix should be removed" (referring to the localized abscess). The answer is, "In our opinion this is inadvisable, except possibly when the appendix hangs into the abscess cavity."

In the chapter on peritonitis comes a long delayed recommendation of rubber gloves. "A point in these operations, to which we attach importance, is that in our opinion the surgeon ought to wear india-rubber gloves. We do not advocate them as a general rule; but we certainly think that the operator ought to wear them in this operation, not so much for his own sake as for that of the patients upon whom they may have to operate subsequently."

Hernia is treated in some thirty pages, a small proportion in a seven volume work. The authors make some rather remarkable distinctions in their choice of operations for inguinal hernia. "In young children with quite strong muscles we do not interfere with the deeper muscles at all; in adults with small herniæ and fairly strong muscles, we generally employ Macewen's method; whereas, in older people, or when the canal is widely dilated and the muscles feeble, we prefer Bassini's operation."

CHARLES LANGDON GIBSON.

THE DIAGNOSIS OF SURGICAL DISEASES. By DR. E. ALBERT, late Director and Professor of the First Surgical Clinic at the University of Vienna. Translation by ROBERT T. FRANK, A.M., M.D., with fifty-three illustrations. New York: D. Appleton & Co., 1902.

The oft-uttered opprobrium that the modern surgeon is not as skilled in diagnostics as his medical *confrère* would seem to find its justification in the comparatively few works devoted to surgical diagnosis exclusively, whereas many such on medical diagnosis are extant. The appearance, therefore, of this book we trust marks a turning-point that may stem the tide of a flood

of surgeries rich in description of techniques, with diagnosis ever subordinate.

The translator has admirably preserved the spirit and style of the original "Diagnostik der chirurgischen Krankheiten," wherein there is pictured live clinical surgery, wherein the student is taught that not any one symptom or group of symptoms stands for a disease, but that logical analysis in every instance will lead to a correct diagnosis approaching a mathematical certainty.

The laboratory teachings of bacteriology and pathology are not belittled, but only such find mention as are of practical value in adroitly aiding the diagnosis at the bedside. As expressed on one of the pages, the method of diagnosis the author would encourage is what Dieffenbach styled "autopsy" in its restricted sense, *i.e.*, perception by means of inspection. This under-current is felt throughout the book; but right here we regret to state that masterly as the subject is presented, yet the pre-eminence of differential diagnosis is not duly emphasized. The *modus operandi* of making a diagnosis is elucidated by occasional citation of concrete instances.

The subject matter is considered regionally, but by no means is the vast field of disease covered, since we have not before us an index of surgical diseases, but rather a guide of exemplary conditions upon which to build.

This book is, moreover, delightful reading, devoid of drudgery arising from a mere enumeration of signs and symptoms, since the learned author has instilled some history of surgery into these pages by frequent reference to the surgeons of the old school whose acumen developed along the lines of *clinical diagnosis*.

This book is regarded as a classic in its native tongue, and enjoyed so wide-spread a circulation as to call forth eight editions, of the last of which this is a translation, and we rejoice to have in this an excellent English version to place in the hands of students.

It is to be regretted, though, that the dimensions are so large

as to prevent its being carried about,—a feature which materially aided the popularity of the original.

In conclusion, we invite the attention of all teachers of surgery to this surgical diagnosis as good supplementary reading to their clinical and didactic instructions.

MARTIN W. WARE.

ATLAS AND EPITOME OF ABDOMINAL HERNIAS. By Privatdocent GEORG SULTAN, of Göttingen. Edited, with additions, by WILLIAM B. COLEY, M.D., of New York. With 119 illustrations, thirty-six of them in colors, and 277 pages of text. Philadelphia and London; W. B. Saunders & Co., 1902.

The first part of this book is given to the consideration of abdominal herniæ in general, including the details of anatomy, origin, diagnosis, and the several plans of treatment, both palliative and radical.

The accidents of hernia, embracing inflammation, incarceration, and strangulation, are next considered, together with the best means of recognizing and combating these conditions.

Later, each variety of abdominal hernia (inguinal, femoral, umbilical, etc.) receives a detailed description, and all accepted methods of radical treatment are thoroughly and clearly presented.

The latter part of the book comprises an account of the more unusual forms of hernia, such as the obturator, perineal, and sciatic varieties, and the internal forms, such as hernia into the foramen of Winslow. This is perhaps one of the best features of the book; the writer carefully detailing those forms of hernia with which we seldom meet, but for which the surgeon should always be on the lookout, thus avoiding embarrassing errors in diagnosis and treatment. The whole work is thoroughly interesting and concise. The statistical tables, showing the frequency of hernia, mortality, and percentage of recurrences after operation, embrace the experiences of many surgeons, both European and American.

The illustrations, of which there are many, are unexcelled. Anatomical relations, the different varieties of hernia, and the details of all steps in the operative treatment are beautifully and accurately depicted, and greatly assist the authors' descriptions.

WALTER A. SHERWOOD.

THE PRINCIPLES AND PRACTICE OF GYNÆCOLOGY. By E. C. DUDLEY, A.M., M.D., Professor of Gynæcology, Northwestern University. Third Edition. Philadelphia: Lea Brothers & Co., 1902.

In this edition the author has thoroughly revised his former ones, and has included the majority of the more recent advances in gynæcology. The manner in which the various pelvic disorders are presented is exceptionally good, since, instead of the reader having to consider lesions as isolated facts, he finds them portrayed by the author in conjunction with the morbid processes which ordinarily accompany them. Tabulated parallel columns are freely used to emphasize points in the differential diagnosis of many subjects.

The illustrations are profuse and accurate; many are in colors, including twenty-two full-page plates in colors and monochrome. Many of the major and minor operations are fully illustrated, indicating the various procedures step by step; for example, hysteromyomectomy, in twelve drawings, vaginal hysterectomies in fifteen, ovariotomy in eight, etc. The author has succeeded in presenting his subject in a complete and thorough manner.

JAMES T. PILCHER.

THE TRANSACTIONS OF THE EDINBURGH OBSTETRICAL SOCIETY. Vol. xxvi. Session of 1900-1901. 8vo, pp. 323. Edinburgh: Oliver & Boyd, 1901.

Each of the great medical centres of the world contributes its share to the general fund of knowledge, and each, as time goes on, becomes especially associated, in the minds of the pro-

fession as a whole, with some especial phase of research. In recent years surgery has made the most noticeable strides along the road of progress, but in Edinboro, while its surgeons maintain just repute, especial attention has for years been paid to obstetrics. In 1840, a group of men, who were interested in this particular work, organized the Edinburgh Obstetrical Society, with Dr. William Beilby and Sir James Y. Simpson as President and Vice-President respectively. Sixty years have elapsed, but the Society still flourishes, and the twenty-sixth volume of its proceedings has just been published.

The communications received by the Society are classified in three groups: In the first of these those relating strictly to obstetrics are found. "Cleidotomy, an operation accessory to craniotomy and basilysis," by J. W. Ballantyne; "Uterine retraction, with special reference to the mechanism and management of the third stage of labor," by D. Berry Hart, and an interesting discussion of the subject opened by A. R. Simpson, and "Eclampsia and the thyroid gland," by H. Oliphant Nicholson, are the three most important papers, and each of these may prove to be the gateway to a new field of thought.

A number of pathologic processes affecting the female genitalia, and having a more or less direct influence upon child-bearing, are next grouped together. Some psychoses following pelvi-abdominal operations are described by J. Halliday Croom. A primary carcinoma of the female urethra and its operative treatment is the subject of J. A. C. Kynoch's communication. Other more common lesions were presented. H. M. Church has compiled a number of extracts from the Talmud and from Celsus illustrative of the state of medical science at the beginning of the Christian era, and his observations upon the effects of these ancient teachings form a readable article.

In the last group some miscellaneous articles appear, including a good summary of the art of vaccination by J. B. Buist. Here, too, appears a series of three articles by D. Berry Hart

upon the morphology of the human urinogenital tract, extroversio vesicæ, and apparent low implantation of the ureteric opening, which are among the best articles in the book and represent, aside from their literary value, an amount of original work in the laboratory far exceeding the published results. Some well executed drawings accompany this valuable thesis.

For the members of the profession as a whole the presidential address by R. Milne Murray is of unusual interest. Obstetrics is, of course, the text. The importance of the work of Naegele, Simpson, and Lister is shown, and their discoveries are well correlated with current medical teaching. The need of further study is accentuated, however, by the queries propounded as to the true significance of menstruation, the true duration of pregnancy, the cause of labor, and the cause of eclampsia. These riddles are yet to be solved.

Dr. Murray, moreover, throws some needed cold water upon the flames of medical self-satisfaction by clearly showing that, notwithstanding the aids of modern science, the maternal mortality in private practice from puerperal fever is nearly double that in similar practice a half century ago. The misuse of anæsthesia and the ridiculous parody which in the hands of many practitioners stands for the use of antiseptics are in the author's opinion the chief factors in this terrible increase in mortality. In a word, the use which has been made by many of two of the greatest blessings of humanity has converted them into little else than a curse. Normal labor is a natural process which is best left to itself, and the less the patient is disturbed with the paraphernalia of obstetrics before or after the better.

HENRY P. DE FOREST.

THE PATHOGENESIS AND PATHOLOGICAL ANATOMY OF ENLARGED PROSTATE.

FROM THE PATHOLOGICAL LABORATORY OF THE BOSTON CITY HOSPITAL.

By L. R. G. CRANDON, M.D.,

OF BOSTON.

This work is undertaken largely with the view to investigate the conclusions of the monumental work of Ciechanowski.[1, 2] To him, more than to any other, are due the thanks of the profession for new and careful work and for deliberate and conservative conclusions.

For personal direction and help in this study I wish to give the most sincere thanks to Dr. F. B. Mallory. The surgical specimens have been very kindly given to me by Dr. Paul Thorndike, and for unlimited access to post-mortem material I am indebted to Dr. Councilman and Dr. Mallory.

The number of senile prostates examined was thirty-seven, of which twelve were enlarged, twenty-four normal in size, and one small.

Urinary symptoms, which at present may be loosely designated "prostatism," are seen in many men over fifty. The proportionate number may not be determined with any accuracy. Thompson held that there might be a slight enlargement of the prostate without symptoms in about one in three men over sixty years, and that a marked enlargement is seen in one in seven after that age. The symptoms are increased frequency of micturition, incomplete emptying of the bladder, with residual urine, or distention with dribbling. Of men with these symptoms, it is estimated that only 15 per cent. have enlarged prostate; and, although it will be shown that disease and change in the bladder-wall are probably important

factors in producing this condition of prostatism, nevertheless, they alone are probably not sufficient, for one never sees senile vesical inertia with retention in women, where directness and permeability of the urethra are not affected. Hence, mechanical obstruction in the form of prostatic enlargement at the outlet of the bladder must be always important among the elements of "prostatism."

I have attempted in the following notes to compare and record differences in senile prostates, enlarged, normal, or small, and in some degree to study the accompanying bladder-wall changes.

Methods.—In general, for histology, preservation in Zenker's fluid was found the best. Formalin, 10 per cent. solution, was used for hardening and preserving specimens for gross examination, and also for special nerve-stains. The prostates were embedded, some in paraffin, many in celloidin, and cut of varying thicknesses (seven to twelve microns). All stains were used, but principally Mayer's hemalum and eosin, Van Gieson's stain diluted and with enough additional picric acid to make the yellow predominate over the red. For minute changes in the proportions between muscle and connective tissue, Mallory's connective-tissue stain [50] gives marvellous detail. Nerves and nerve-sheaths were stained by Pal's modification of Weigert's method.[51] For elastic tissue, Weigert's stain [52] was used.

PART I.

THE BLADDER-WALL IN VESICAL INSUFFICIENCY.

Examination in the gross of a bladder and prostate cut in a sagittal plane, through the urethra, in subjects over forty-five years, shows in over half the cases, at the origin of the urethra, a distinct lip, rising slightly above the level of the urethral floor, then dropping sharply in a perpendicular behind, to form the anterior wall of a bladder-pouch (Fig. 1). This lip is formed by the prostate, which may or may not be enlarged, and the pouch varies much in size, not corresponding necessarily to the size of the prostate. This pouch contains the

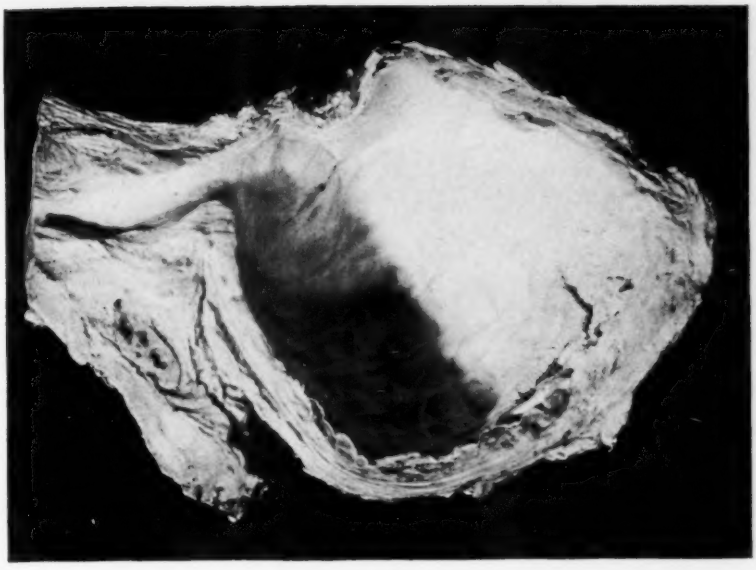

FIG. 1.—Sagittal section of senile bladder and prostate, showing the fibrous bands in the wall of the atrophic bladder, the retroprostatic pouch, and the orificial prostatic lip.

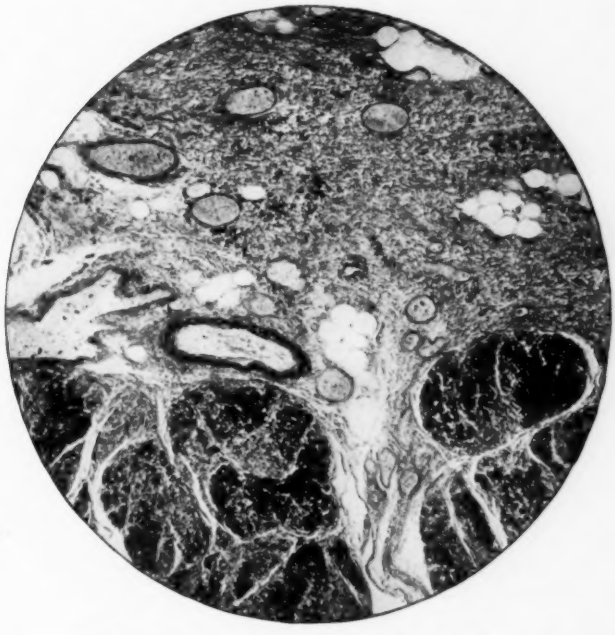

FIG. 2.—Showing fibrous infiltration of the bladder-wall muscles.

residual urine and is a prominent factor in prostatism, and, inasmuch as it is found without enlarged prostate, we must seek a partial cause of it, at least, outside the prostate.

What changes in the bladder-wall are to be seen where this pouch and vesical insufficiency exist?

At least five possible changes are to be considered:

I. *The Presence of Fat in the Senile Bladder.*—Dittel [17] laid the cause of senile bladder to fatty degeneration. Maas [47] laid it to fatty degeneration of hypertrophic bladder-muscles. Rokitansky [68] describes it loosely as a colloid degeneration. Ciechanowski [1, p. 207] found fat between the outer muscle-bundles in streaks, occasionally subserous, more rarely submucous, where it is never normal; and he concludes that bladder insufficiency does not depend on fatty degeneration, because this fat is not seen by any means in all cases and only rarely in muscle-cells.

I have seen it between muscle-bundles and subserous, where the fat globules are large and borne in cells with relatively little protoplasm; that is to say, having the characters of normal adipose tissue. Only occasionally muscle-cells show fine fat globules, and then only in bundles where other and much more extensive and important changes, as will be noted, are present. With this slight exception, fat in the bladder-walls apparently has only the significance of fat deposit anywhere.

II. *The Presence of New Connective Tissue and of Muscle Changes in the Senile Bladder.*—Orth [61] has noticed atrophy of bladder-muscles in chronic dilatation of the bladder. Launois [43] holds that by overwork the muscle elements become surrounded with fibrous tissue, which finally suppresses their action. Guyon [32] believes that all changes of a connective-tissue kind are due to the impaired nourishment consequent on arteriosclerosis of the bladder. Bohdanovicz, quoted by Ciechanowski [1, p. 207] holds also that over-exertion of bladder-muscle leads to fibrous changes; but he ignores cases of bladder insufficiency where no signs of previous hypertrophy are to be found; cases, in other words, where no cause for bladder-

muscle hypertrophy exists. He gives no heed also to chronic inflammation as a possible cause of some of the changes which he observes. In the study of senile changes in the bladder-wall, therefore, such changes as are plainly due to chronic inflammation should be clearly distinguished.

Ciechanowski has done so, and, shutting out those cases which have the submucous fibrous deposit of old cystitis, makes a series of careful measurements of transverse sections of bladder-wall. He adds together the total area of muscle-elements and compares it with the area of the interstitial connective tissue in section of definite size, submucous and subserous tissue being excluded. He finds that the amount of connective tissue compared to that of muscle in the highest grades of arteriosclerosis varies between 1 : 4 and 1 : 1.2. The fraction for the normal bladder given by both Orth and Ciechanowski is 1 : 3. The latter then observes that interfibrillary and interfascicular fibrous tissue only appears increased when there is a considerable amount of new connective tissue about the vessels. Hence, shutting out these cases, which from the apparent vascular origin of the fibrous tissue seem to be inflammatory in origin, he concludes that the connective-tissue increase is only apparent and fills in the place of truly atrophied muscle. He compares cases which differ only in respect to age with no cystitis, cases where no cause for bladder-muscle hypertrophy exists, and finds his relation of connective tissue to muscle go from 1 : 3.5 up to 1 : 2, according to age alone, and hence concludes that the change is true senile atrophy. Into this matter I have not gone with detail. My specimens (Fig. 2), excluding those apparently inflammatory, show irregular distribution of the new-formed fibrous tissue within the muscle-bundles. Such fasciculæ of muscle as remain stain well and show striæ. The fibrous tissue between the separate muscle-fibres, stained by Mallory's connective-tissue stain, is repeatedly seen in amounts greater than in the bladder-wall of youth. I am inclined, therefore, to believe that, although the senile bladder having no obstruction may undergo atrophy to a degree similar to that of the whole muscular system, at the same time there is apparently

a tendency to a true bladder sclerosis, an irregular growth of new connective tissue within muscle-bundles, and at the expense of the fibres. This could be explained on the ground of probability as being a sequela of chronic inflammation, but that repeated sections show this quantitative change without submucous or subserous fibrous thickening or any remains of round-cell infiltration.

III. *The Presence of Sclerosis in the Vessels and Walls of the Senile Bladder.*—Much complicated and ingenious theorizing has been devised to demonstrate a sequent connection between such a sclerosis and the conditions found in prostatism. For example, a senile change of both bladder and prostate; more specifically, changes in structure in the parts in question which depend upon a general arteriosclerosis with modified blood-supply,—that is, that prostatism depends upon the local effects of a remote or general cause. A modified form of this theory declares that prostatism is a result of sclerosis of the vessels of the urogenital system only.

Another subdivision under this theory makes the process a local one, consisting in so-called "sclerosis" of bladder and parts connected, that is, an increase of connective tissue in the bladder-wall, at the expense of the muscle, with contraction in places, lack of tone and distention in other parts, such as the formation of a pouch behind the prostate and the constant pressure of residual urine and its consequences.

I find that cases with intima and media thickened and lumen correspondingly small show the fibrous change in the muscles. On the other hand, cases with little or no change of vessels within the bladder-wall may show a considerable loss of muscle-fibres and corresponding new interfibrillary or interfascicular connective tissue.

It seems apparent, then, that there occurs in many senile bladders a quantitative change in the structure of the walls not due to inflammation, and that this change, while it may correspond remotely to the general muscle changes of old age, does not depend on arteriosclerosis within the bladder-wall.

IV. *As to the Rôle of Urethral Obstruction in the Senile Bladder.*—In the development of prostatism and of the vesical pouch we have seen that the first element, and the one which may alone be sufficient, is atrophy of the bladder-muscle and replacement of the muscle by fibrous tissue. Such a bladder is less elastic than the unimpaired bladder; it tends more frequently to empty itself, and contracture, the usual rôle of new connective tissue, takes place. Grossly, fibrous bands intersect and form sharp, submucous ridges (Fig. 1). This more or less inelastic sac now no longer tends to maintain its natural ovoid form, and, weighted with urine by force of posture and gravity, it falls towards the rectum and perineum. The orifice of the bladder, however, the beginning of the prostatic urethra, situated above the isthmus of the prostate at the apex of the trigonum, is fixed. The prostate is held firmly in relation to the pubes by the puboprostatic or anterior ligaments of the bladder. At this point, slightly posterior to the isthmus, in the plane of the posterior urethral sphincter, there forms an orificial lip, behind which falls away the pouch. To form this lip there need be no prostatic enlargement; in fact, the total volume of the prostate may be diminished. On section sagitally (Fig. 3) this lip is covered with mucosa, and immediately beneath it, and extending forward to be continuous with the prostate, is always a collection of prostatic glands. They may be few in number, at times dilated, but always present. Beneath them and cut transversely is the more or less wedge-shaped section of the inferior part of the posterior sphincter (Fig. 3, *s*). From this condition, all stages up to the development of a true middle lobe may be seen. And this form of enlargement, like other forms of clinically enlarged prostate, is essentially glandular. Ciechanowski has shown successive stages of the development of a nodular middle lobe in this situation by dilatation of this small group of glands (Fig. 3, *g*) just within the posterior half of the sphincter, and by increase of their surrounding tissue, extending downward and pressing always on the sphincter till the latter is fully and permanently dilated, is atrophied, and finally, under this middle lobe, dis-

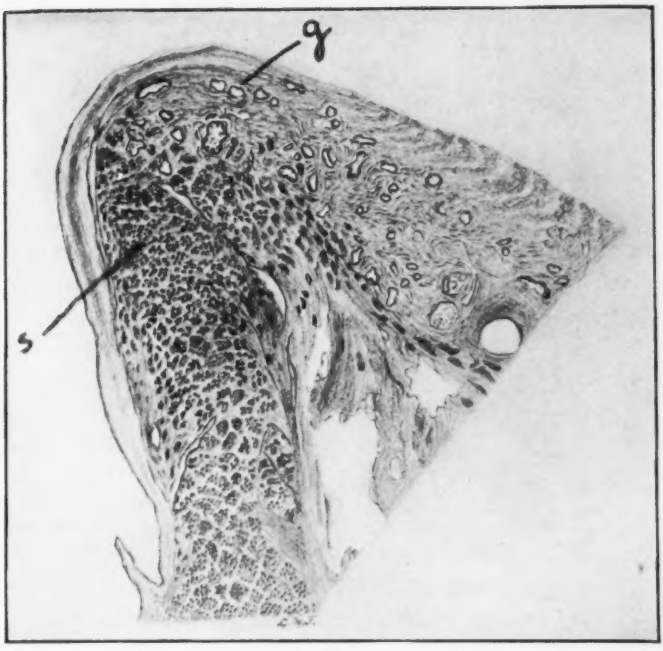

FIG. 3.—Showing the posterior orificial lip. At the left, forming the anterior wall of the retroprostatic pouch, is the wedge-shaped section of sphincter (*s*). Superiorly, just under the urethral mucosa, are the few isolated prostatic glands (*g*), which are always present, which serve as origin of the third lobe.

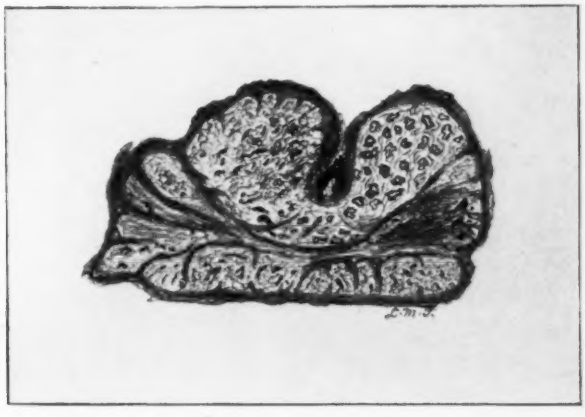

FIG. 4.—Showing a fairly distinct horizontal transverse fibrous partition in a coronal section.

appears. This prevents effective shutting off, and the prostatic urethra is likely to remain filled with urine and constant desire to micturate be present.

This nodular form of prostatic outgrowth may appear laterally, and so deviate or distort the urethra. If there is a real obstruction to outflow and not mere deviation of the urethra, and there be any reactionary power in the bladder-wall, its muscles will hypertrophy. Age and inflammation (*vide* V., *infra*) will limit or destroy this power of hypertrophy. And furthermore, hypertrophy of bladder-muscles already existing may yield rapidly before foul and persistent cystitis. Cases which show merely the posterior orificial lip and pouch behind, without nodular or valve-like urethral obstruction, never show bladder hypertrophy.

V. *On the Rôle of Chronic Inflammation in the Senile Bladder.*—Chronic cystitis is an important secondary cause of vesical insufficiency. The usual remote origin of the cystitis is a persistent and sometimes latent gonorrhœal infection; a continual aggravating cause is catheterism. As has been already stated, there is no evidence, gross or microscopic, that such inflammation is an essential in the changes observed in insufficient bladders. The bladder-wall in cases of long-standing cystitis may show the greatest degree of thickening. This thickening on section is made up partly of a round-cell infiltration of mucosa and submucosa, but mostly of a considerable submucous development of fibrous tissue, which in old cases raises all over the inner aspect of the bladder (Fig. 1) a tangle of crossing ridges. These ridges may be so prominent as to convert the inner aspect of the bladder into a succession of pockets or saccules. There is some new connective tissue formed between the bundles of muscles, with round cells here and there through it which show its inflammatory origin. New subserous fibrous tissue may less commonly form part of this thick wall.

The importance of chronic inflammation in the senile bladder lies principally in the fact that it rapidly intensifies all the changes and symptoms already existing. The bladder suffer-

ing from it is less tolerant, contracture is greater, atrophy is more rapid.

VI. *On the Presence of Stone in the Senile Bladder.*—This is of great frequency, but often undemonstrated before operation because (*a*) the symptoms of stone are masked by those of obstruction and cystitis; (*b*) the calculus forms and remains in the retroprostatic pouch, and may be even quite enclosed in one of the saccules referred to. Large stones felt by rectum sometimes are mistaken for enlarged prostate.

Conclusions.—(*a*) Senile vesical insufficiency, which may be called clinically "prostatism," is not a single entity, but a complex condition. It has a distinct anatomical basis and may be due to one or more of several causes. (*b*) It is not due to fatty degeneration or infiltration of bladder-muscle. (*c*) It is not due to arteriosclerosis of bladder-vessels. Changes in walls of blood-vessels have no constant relation to change in the bladder-wall. (*d*) The causes of bladder insufficiency are:

(1) Atrophy of bladder-muscle and new growth of connective tissue, finally infiltrating the muscles.

(2) Mechanical obstruction at the beginning of the urethra. This may be simply a posterior lip at the orifice in front of a retroprostatic pouch; it may be a true middle lobe of the prostate acting as a valve; it may be a nodule or enlargement of one or both lateral lobes protruding into the urethra.

(3) Chronic cystitis intensifies these two causes, namely, muscle atrophy and obstruction at the exit, by means of the structural changes due to inflammation.

(4) Stone in the bladder increases the symptoms, but is probably rarely a primary cause of insufficiency.

(*e*) Although structural changes in the bladder-wall may alone be sufficient to cause prostatism, the most important factor is probably obstruction. (*f*) The tendency to all these changes increases with age; and, finally, (*g*) the most marked cases are those where atrophy of bladder-muscles, connective-tissue infiltration, enlarged prostate, and chronic inflammation are all present.

PART II.

ON THE STRUCTURE, GROSS AND FINE, OF ENLARGED PROSTATE.

A. *The Normal Prostate.*—The normal prostate is classically and well described as a chestnut-shaped body adjoining the neck of the bladder, inclosing the first part of the urethra. The urethra runs nearer the anterior than the posterior aspect of the gland, that is, about .7 centimetre from the former and .9 centimetre from the latter, but it varies.[25] The narrow end or apex of the prostate is directed downward and forward to within 1.5 centimetres of the symphysis, to which it is connected by thickenings of pelvic fascia. The posterior part or base is close to the rectum, through which it may be felt, about six centimetres above the anus.[48] Its measurements are about 3.5 centimetres across at its widest, *i.e.*, bilaterally; three centimetres from base to apex, and about 2.5 centimetres in thickness, *i.e.*, in the direction of the urethra. The weight of the normal prostate ranges from 13.6 grammes to 21.4 grammes, the average being eighteen grammes.[72] These limits are not strict. A sheath derived from the rectovesical fascia incloses the prostate and contains the prostatic veins. This capsule is fairly distinct. The rectal surface shows two grooves which meet in front and indicate the course of the seminal ducts. The gland presents a lateral lobe on each side of the base, and a middle portion or isthmus which is included between the ejaculatory ducts and the neck of the bladder.

The prostatic urethra, about three centimetres long, is dilated in its middle, where there arises from its floor the verumontanum (Colliculus seminalis, Caput gallinaceum).[69] The ejaculatory seminal ducts, passing forward from the seminal vesicles, traverse the lower part of the prostate and empty into the urethra by two slit-like openings on or very near the crest of the caput. The prostatic ducts empty through the wall of this portion of the urethra by twelve to twenty (fifteen to thirty-two, Svetlin, quoted by[75]) openings, most of them on the floor of the urethra in a fossa on each side of the caput, called the prostatic sinus. The two largest prostatic ducts

empty at the caput just behind the mouths of the ejaculatory ducts (Walker, loc. cit., 253). In the middle line, close in front of the orifices of the ejaculatory ducts, in the forward part of the caput is the prostatic utricle (Sinus pocularis, Uterus masculinus). This is a blind pocket, about .8 centimetre long, extending upward and backward beneath the isthmus.

Histologically speaking, the prostate normally is made up of smooth muscle-fibres, of rather cellular connective tissue, and of true gland-tissue in the proportions roughly of 1 : 1 : 2, together with more or less elastic tissue. On examination of a section here and there, no idea of a definite order of arrangement of these elements may be obtained. Walker (loc. cit., 244), by a most careful study of serial sections in the dog, has come to the following conclusions with regard to the distribution of

Muscle in the Prostate.—"That the vesical end of the prostate is surrounded by a thick muscle composed of longitudinal, circular, and oblique fibres, from which a large process projects anteriorly and posteriorly between the two glandular hemispheres; and a thick sheath is sent out on either side, which encases the fore, lateral, and dorsal surfaces. The posterior process extends to the urethral end, where it spreads out round the external surface in that region. From these muscular divisions, septa pass into the gland and surround the lobes in a circular and longitudinal manner, giving to each lobule two distinct coats. The muscle-coats of the urethra and bladder are inserted into the prostate and not continued through it, and the urethral coats in the prostatic portion are replaced to a considerable degree by prostatic substance." Striated muscle in the prostate is found only as a part of the external sphincter of the bladder at the urethral end of the gland, principally as a thick layer of circular fibres.

The Connective Tissue part of the stroma can be only fully recognized and duly appreciated when stained by Mallory's connective-tissue stain. It may then be seen to form one-fourth or less of the gland, a fairly dense, fibrous structure, rich in

FIG. 5.—Showing the distribution of elastic fibres in the normal prostate.

FIG. 6.—Showing the senile caput with its apical duct, amylaceous bodies, and a slight degree of small round-cell infiltration.

cells at birth and in youth, becoming more fibrous as age advances. On gross coronal section (Fig. 4) in the normal prostate of middle life and later, a distinct transverse, horizontal, fibrous partition is seen. This runs in a plane across the gland about one-third of the distance from the urethra to the posterior surface, and, as it approaches the sides, inclines downward towards the lateroposterior angles. Branches of this plane often curl upward to more or less encapsulate the lateral lobes, merging finally with the sheath.

Microscopically, these septa, more dense and fibrous than the rest of the connective-tissue stroma, send out in all directions ramifications of increasing fineness round and between the muscle-masses, between and supporting the gland lobules. This tissue accompanies the innumerable capillaries of the organ. Between these smallest vessels and the cellular stroma in dogs, Walker finds a membrana propria made of finest connective fibrillæ. Regnauld,[67] quoted by Walker, finds none; Langerhans cannot differentiate it; Walker cannot demonstrate it in the human. A few small round cells, plasma cells, and leucocytes are to be seen normally, but in the larger septa rather than near the lobules a point of difference to be noteworthy later.

Elastic Tissue in the normal gland has been carefully observed by Walker (loc. cit., 248), who also quotes Antonini.[5] Walker finds surrounding the urethra, just under the mucosa, a sheath of longitudinal fibres. The outer fibres spread into the gland and form a figure-of-eight net-work round each prostatic duct, apparently making an elastic sphincter for each. Extensions are seen into the larger fibrous septa, and from there fine fibres arrange themselves in a circular manner round the alveoli (Fig. 5). The caput is especially rich in elastic fibres. They are arranged round the utricle about each ejaculatory duct, besides a considerable submucous layer of it all over the prominence.

The *glandular portion* of the normal prostate consists of thirty to fifty simple tubes, straight in the embryo, later branched, and finally forming complex lobules. They unite

into a smaller number of excretory ducts, and, finally, empty into the prostatic sinuses as already described. In the upper portion of the prostate the alveoli are smaller and more saccular, smallest at the exit. In the lower part of the gland the tubules are longer [71] (Quain, loc. cit.). In the anterior commissure the tubules are relatively few in number and simple.

The epithelium lining the glands in the dog have been described with the greatest exactness and detail by Walker, and in man by Langerhans.[42] The cells are arranged in one layer and vary in shape,—long, columnar, cuboidal, or even irregular, with relatively large nuclei near the base in the primary lobules, while in the ducts the cells are more flattened with nuclei near the centre, and at the exits are merely squamous, of the urethral type. The alveolar secretion is seen as a shrunken, finely granular mass, staining pink by eosin. An occasional desquamated granular epithelial cell is seen, and in senile prostates, which in no other way deviate from the normal, there are so frequently seen round, stratified, so-called *amylaceous bodies* that they must be mentioned in describing the normal prostate. They vary in size, up to filling of the saccule, and consist often of clearly defined concentric strata. Some stain red, others blue by Mallory's connective-tissue stain.

The *Caput gallinaceum* is made up of connective tissue and muscle, together with a relatively large amount of elastic tissue. The glands of it are near the summit and open by a common duct, just anterior to the centre of the crest (Fig. 6). Muscle surrounds these glands as elsewhere, but does not extend to near their orifices. Adenoid tissue, described by Walker (loc. cit., p. 250), I have not seen. He says, "In quite a number of prostates, bits of adenoid tissue were scattered here and there throughout the tissue, generally near the lateral surfaces Two or three small nodes are usually near together with a rather thick layer of connective tissue between them. In some of the nodes are minute channels lined by endothelium; these are most probably lymph vessels."

The *vessels* of the prostate are branches of the vesical,

hæmorrhoidal, and pubic arteries. They pass into the prostate along with the larger connective-tissue septa, where they break into smaller twigs, follow the ducts to the lobules, and break up into capillaries about the alveoli.[64] On the sides and base of the prostate in its fibrous sheath, the veins form a plexus. This is highly developed in old subjects. These veins behind pour into branches of the internal iliac. In front they empty into the dorsal vein of the penis.

Lymph channels and vessels may be found between the two layers of the fibrous sheath.

The *nerves* are derived from the hypogastric plexus of both sympathetic and central origin. They contain both medullated and non-medullated fibres, and show here and there ganglion cells. They are seen in the posterior and lateral surfaces and pass along the fibrous trabeculæ towards the alveoli. Their course is extremely difficult to follow, and practically nothing is known of their termination.

B. *The Senile Enlarged Prostate.*—The character of the changes which together may be seen to make up the structure, gross and fine, of the enlarged prostate, is to be most clearly understood by a separate presentation of the changes observed in each structure, particularly the glands, the muscle, and the connective tissue.

Gross.—The senile prostate which has suffered general enlargement attains a greater size than that in which one lobe has increased in size. The limits of *weight* of Thompson's cases were twenty-two to 180 grammes; of mine, twenty-seven to 180 grammes.

The capsule varies much in strength and thickness,—in some cases the gland may be easily shelled out, in others it is hard to differentiate gland from capsule.

The *consistence* of the enlarged gland may be extremely spongy, through degrees of increasing firmness, up to a hard, fibrous feel. The gross appearance of a *cut section* corresponds to these differences in feel, that is, from that of a fine sponge to that of a cross cut of a fibroid of the uterus. Some show on the cut surface many distinct, encapsulated, round, fibrous

bodies, which protrude above the level, as if relieved from the compression of a tight capsule. This is the "Knotige" form of enlargement described by the Germans. From all, except the hardest, there comes, from a cut surface on squeezing, a slightly gelatinous turbid fluid.

The distribution of the enlargement is irregular. It appears most often in the lateral lobes, next often in the lateral lobes and in the form of a middle lobe, next often as a middle lobe alone, and, lastly, as one lateral lobe. The anterior commissure rarely suffers enlargement, a fact of considerable significance, as will be shown.

It is now necessary briefly to consider the gross details and immediate mechanical effects of enlargement of the prostate in each of the varieties just mentioned.

1. *Bilateral Enlargement.*—In this form the urethra is increased in length, and its cross section is transformed from a triangle to a vertical slit. To do this, the side-lobes have grown downward and backward, and the floor of the prostatic urethra is depressed below the level of the posterior lip of the bladder orifice. In this manner the posterior obstructive lip (Mercier's bar) can form even when the hypertrophy is of the lateral lobes; the sphincter remains normal, while the urethral floor anterior to it is depressed, and a bar is formed without the necessity of bringing in an hypertrophied sphincter to explain it. It is in this way, together with the bladder-wall changes, that retention begins in cases of side-lobe enlargement.

2. *The Formation of a Middle Lobe.*—This takes place either as a part of a general enlargement or alone. Its interest grossly is in its relation to the posterior half of the sphincter muscle at the orifice. The older observers [16] held that the middle lobe arises from the portio intermedia, anterior to the sphincter, and grows up between the urethral mucosa and the posterior half of the sphincter. The sphincter thus comes to lie always behind a sort of valve-like tumor, later becomes flattened out, and finally disappears through atrophy. More careful later observation [40] makes it probable that this polypoid middle lobe has nothing to do with the posterior commissure

or isthmus, which is always below the sphincter, but that it develops from the few isolated, prostatic acini which lie between the mucosa and the sphincter at the orificial lip of the bladder (Fig. 3, *g'*). All agree that the sphincter posteriorly disappears, either being pressed upon by the new growth above it, or suffering infiltration by the growth. This middle lobe may act as a cause, therefore, of either retention or incontinence; retention, if the growth fit like a ball-valve exactly into the orifice, incontinence, if it does not fit the orifice, and at the same time does continuously stretch and so destroy the tonus of the sphincter. If, besides the pressure from above, from the middle lobe, there is also pressure from below and in front from enlargement of the rest of the prostate, the sphincter becomes pushed up into the true bladder-wall. Thus, so far as function goes, the sphincter disappears, because in this position it has no relation to the orifice, and the bladder must be then continuously incontinent unless there be a valve. At this point, however, it must be made finally clear that these ball-valve growths which arise from the relatively isolated prostatic glands under the mucosa of the orifice, are to be distinguished from the point of view of mechanics, from the posterior lip already described. This *barriere vésicale* of Mercier is a mechanical obstacle; it favors the formation of a pouch, but its pathogenesis is that of the third lobe. They both arise from dilatation of prostatic glands,—those of the valve-like lobe coming directly from the isthmus and tending to fill the exit, while the posterior lip obstruction is somewhat behind the orifice. It is definitely clear that this bar is never due to hypertrophied sphincter.

3. *Enlargement of One Side-Lobe.*—This is relatively uncommon. It develops in the direction of least resistance, which seems at first to be towards the periphery, but finally is always towards the urethra, where it narrows that passage, lengthens it, and causes it to deviate laterally, according to the contour of the new growth. Unless it be sufficient in amount actually to interfere with the patency of the urethra, there is

likely to be little retention or incontinence, unless there be also some of the other causes present in sphincter or bladder-wall.

4. *General Enlargement.*—This is one of the common forms where, besides bilateral enlargement, there is also developed a third lobe. The bladder-pouch appears early, and the urethra suffers narrowing from side-pressure, or is obstructed, or is held patent according to the final relation in size between the enlarged portions of the prostate in a given case. In short, the changes in function due to general enlargement are a combination of the changes seen in enlargement of the separate parts.

Microscopic.—It now remains to go into a detailed microscopical study of the enlarged prostate.

Proportion of Constituents.—In the normal prostate, as we have seen, the proportion of muscle, connective tissue, and gland tissue is roughly 1 : 1 : 2. In the enlarged prostate, in practically all cases, the observer is at once impressed with the relative increase in the area taken up by glands; no definite proportion, however, can be worked out.[55]

Muscle in Enlarged Prostate.—The muscle-sheaths which start at the vesical end remain about fixed in size, but often show some fibrous infiltration. The coats which surround the acini and ducts no longer show a clear division into two coats; in fact, more often around dilated glands only indistinct traces of muscle tissue remain. Remains of the larger septa, from which the coats that surround the glands arise, may be seen cross-cut here and there in nearly all sections. The cells stain well, the nuclei show no active subdivision, and a close intermixture of fibrous tissue with each bundle exists. Many groups of elongated spindle-shaped cells, which I believe hitherto to have been considered new, smooth muscle cells, stain blue by Mallory's connective-tissue stain, and they should without any doubt, therefore, be classed as new connective tissue. About some glands may be seen portions of muscular capsules occasionally thicker than those in the normal gland. This is the only suggestion of true "hypertrophy" to be seen in enlarged prostate.

FIG. 7.—Showing areas of scar-tissue, round-cell infiltration, and glands wholly or partly denuded of epithelium.

FIG. 8.—Showing well-marked scar-tissue areas and denuded glands with pathological contents.

The *connective tissue* part of the stroma may be greatly increased in relative quantity. The average amount could be roughly estimated as two or more times as great as that of muscle. It is richly cellular for the most part, but presents two differences from that of the normal prostate. The first of these differences, the real importance of which was first made clear by Ciechanowski, is the presence of small round cells (Fig. 7). These cells are seen most often in the fibrous tissue near the acini; they may be diffusely distributed (Fig. 16), and isolated groups of them are also seen. Such groups may, of course, be in relation to glands not cut by the section. The groups are entirely irregular in outline and present no suggestion, in the way of minute channels or pellicle, of the lymph nodes of Walker. The nuclei are single, relatively large, stain deeply with basic stains, and the cells cannot be distinguished from lymphocytes. They are similar in kind and distribution to those seen in chronic mastitis. Examination of every large prostate shows these cells. Many cases show undoubted polynuclear, round cells.

The second distinguishing feature of the new fibrous tissue is the presence in it, here and there, of irregular masses of nearly hyaline, nearly homogeneous, dense, poorly staining fibres, in short, masses of scar-tissue (Figs. 7 and 8). About such scars small round cells may be seen. The masses may be in relation to tubules or apparently apart from them. In the midst of such masses of scar-tissue may nearly always be found remains of glands (Fig. 8). Such gland-remains are usually denuded of epithelium or collapsed by pressure, or, in cases, the presence of a so-called amylaceous body may alone show the previous presence of a gland. Within the scar-tissue may also be seen clumps of the spindle cells of new connective tissue or small areas of round cells.

Such associated appearances, namely, small round cells, well staining spindle cells, and scar-tissue, can be looked upon probably as stages of one inflammatory process.

The relation of these stroma changes to the glands is the next question of importance. In general, all the changes

named are seen to a far greater extent near the central or urethral part of the prostate than near the periphery. The round-cell clumps in particular are seen repeatedly near the walls of the larger terminal ducts (Fig. 9). In addition, there are often areas infiltrated with polynuclear leucocytes. These areas are of any size, even up to small abscesses visible to the naked eye (Fig. 10). Fairly definite rings of the new connective-tissue cells are seen in places near ducts, and the scar-tissue, as has already been noted, may be found many times quite inclosing and compressing a duct of moderate or large caliber, some of these even to complete obliteration. These evidences of proliferation in the stroma are seen, as a rule, not between or round the glands which have suffered dilatation. This is a point of great importance, as will be seen in considering the changes in the glands in an enlarged prostate.

Elastic Tissue in the Enlarged Prostate shows little or no change in quantity,[53] but stains less sharply near dilated glands or near those which have purulent contents. The elastic fibres (Fig. 11) are less wavy and are more closely compact in bundles, as if pressed upon laterally by the dilated glands on one side and the stroma on the other. They form, therefore, in the enlarged prostate, narrow, dark bundles following the outline of the enlarged acini.

The Glands or Acini in Enlarged Prostate.—As has been said, the first impression on examining sections of most enlarged prostates is the apparent relative increase in the area covered by glands. The ducts are in many places wider and the glands are much dilated (Fig. 13). Two glands close together dilate till they are separated only by their respective linings of epithelium, and one or two degenerated supporting connective-tissue fibres between them (Fig. 12) ready to give way. In others, a shelf of fibrous tissue protruding into a lumen is the only remains of a previously existing partition. Other parts of these acini show changes due to dilatation also. The *epithelium* lining the glands and ducts of the enlarged prostate presents always marked changes. The cells are smaller, they are flattened, their nuclei stain less deeply, the

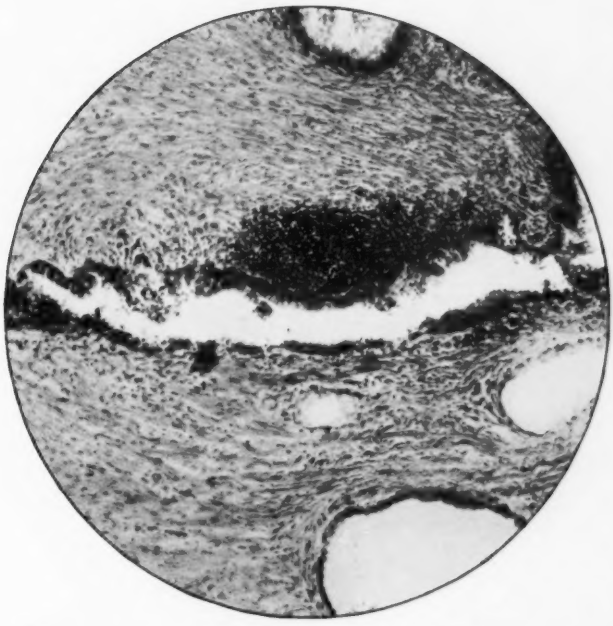

FIG. 9.—Showing round-cell infiltration with minute abscess formation in the wall of a prostatic duct. Dilated and denuded glands near by.

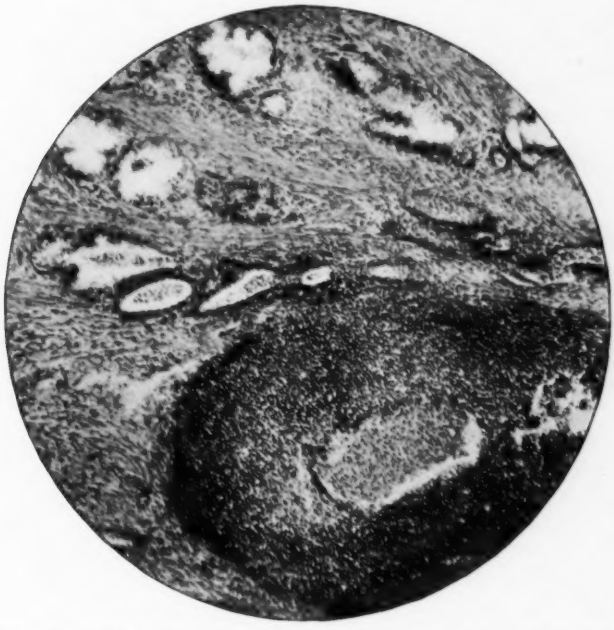

FIG. 10.—Showing microscopic abscess formation surrounding and including a prostatic gland.

FIG. 11.—Showing bundles of elastic tissue squeezed between the dilated glands of enlarged prostate.

FIG. 12.—Showing a stage in gland dilatation; remains of gland-partitions in the form of shelf-like projections. In one place a single compressed line of connective tissue supports epithelium on each side of it.

cytoplasm becomes granular and stains faintly. In places (Figs. 7, 12, 13, 14) the cells have flattened until they are scale-like; in places they have desquamated. In some glands a series of six or more cells still connected together in a row may be seen lying free in the space near the place in the wall from which they have been separated. In other glands, a few flattened nuclei in the wall are the sole remains of the lining membrane, while the final stage of these changes shows no epithelium remaining, but only the gland contents lying free in a space in the stroma. In some of the acini, the degenerated lining-cells desquamate and coalesce in an ill-defined, poorly-staining, granular, or even amorphous mass in the centre of the dilated space, or in other glands, whether or not the wall has been denuded of epithelium, there are seen the so-called "amyloid bodies" or concretions. These are more or less stratified rounded bodies, staining red or blue by Mallory's connective-tissue stain, and contain within themselves small, granular bits of chromatin, often enough to suggest their origin in old epithelial cells. These bodies are constantly found in dilated glands of enlarged and normal-sized prostates, so often indeed as to warrant the belief that they are really a normal senile condition.

The granular or amorphous mass in the dilated gland-space may also show small, round mono- or polynuclear cells (leucocytes) in varying numbers, even up to an amount to make the glandular contents truly purulent. This is particularly seen in the larger spaces. The larger gland-spaces always have pathological contents, that is, epithelial products together with few or many leucocytes; they are never empty. The size of these dilated glands varies much, from the slightly distended tubule up to a macroscopic cyst or abscess. The form of the glands remains normal with some distention, but as the internal pressure increases they become quite round on section in every plane.

It is apparent, therefore, that the view held by Socin [70] and Ciechanowski is amply supported. In enlarged prostate, the essential change is a passive dilatation of the prostatic

glands and ducts induced by the gradual accumulation in them of retained secretion, degenerated cast-off epithelium, and leucocytes. The process is probably not a physiological one because the greater the degree of dilatation the gland has suffered, the greater, as a rule, the number of leucocytes in it. The amount of cast-off epithelium in the gland-spaces suggests an increased activity of production of epithelium, it is true, but not neoplasmic in character. The lining membrane in their sections is only one cell thick, and the proliferation arises from cells which do not show the staining reactions of vigorous epithelium. It is as if an increased rapidity of production of cells had taken the place of production of the usual secretion.

The distribution of the glandular dilatation in enlarged prostate is a matter of the utmost importance and significance. Under this heading, four observations are to be separated:

(1) Many enlarged prostates, on gross section, show here and there all over the cut surface small but still macroscopic, round, fleshy nodules or kernels looking like minute fibroids. Microscopically, these always have for their essential structure one system of enlarged acini. These are the "pseudo-adenomata" of Ciechanowski. Each consists apparently of all the elementary glands which originally arborated into a single duct; obstruction of this common duct by contraction of the new fibrous tissue about it has caused retention of the secretion of all the tributary acini, and their passive dilatation has resulted. In the dilatation, the muscular and elastic layers surrounding each gland of this individual system of glands have been stretched out, have lost their infoldings, and remain, finally, as a distinct spherical capsule round a mass of dilated glands.

Such "pseudo-adenomata" may be seen well distributed all through the two side-lobes, and may be the essential factor of their general enlargement. One lateral lobe alone may suffer enlargement of this type, and much less commonly a middle lobe may develop in this manner.

(2) Another principal, but never distinct, form of enlargement is where the obstructive dilatation of glands does not

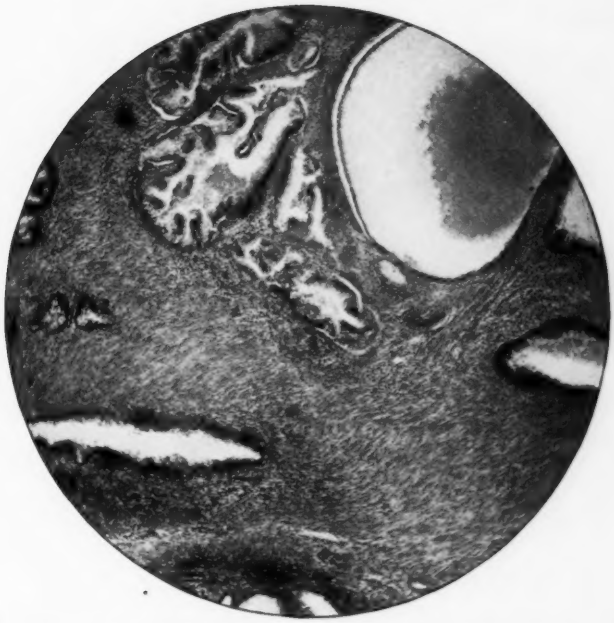

FIG. 13.—Showing the single row of flattened epithelium in a dilated gland; glands in various stages of dilatation; round-cell infiltration.

FIG. 14.—Showing glands dilated, with flattened epithelium; other glands and ducts compressed by fibrous tissue and showing subepithelial round-cell infiltration.

take place in isolated minute gland systems, but shows itself in glands here and there not drained by a common duct. The picture then shows, in one place, one or more relatively large cysts or abscesses; in another place, glands squeezed to partial or complete obliteration (Fig. 14); in another place, a perfectly normal area. In describing these two forms of microscopic change,—that resulting in the formation of knots or nodules, and that which is more diffuse and irregular, not obstructing definite gland systems,—it is quite apparent that the difference is not one in the kind of change, but in its distribution. There seems to be no pure form of enlargement. Every case presents a mixed form, and the different varieties may be seen in one section. It should be here observed that there seems to be no sound evidence that the obstruction to free drainage of prostatic acini lies anywhere but in the surrounding stroma. It has been suggested that the amylaceous bodies obstruct the ducts; but this cannot be true in most cases, because the presence of these bodies is inconstant within the dilated glands; and, furthermore, in half the glands, the bodies are seen in a proximal or peripheral position where they could not obstruct. Analogous examples of obstruction of exit-ducts by pressure of contracting stroma are seen in the formation of minute cysts in chronic mastitis and in varieties of chronic nephritis.

(3) For prostatic enlargement to involve the anterior commissure is exceedingly rare. As has already been suggested, this fact seems particularly significant. Ciechanowski [1, p. 266] has collected only seven cases in all the literature where the anterior commissure was affected, and he quotes Aschoff,[6] who has shown that only a few or no gland tubules exist in this portion of the prostate. If, now, these glands or their muscular coats caused prostatic enlargement by neoplastic growth, there is no reason why such development, that is, a multiplication of glands, should not take place in the anterior commissure as well as in other parts; but inasmuch as passive dilatation of already existing glands is the cause of enlargement, these glands of the anterior bridge, the same in origin

and structure as all other prostatic glands, are merely too few in number and too small to be able to exhibit macroscopic changes. There are exceptions to this rule.

(4) For the last and most important observation on the fine distribution of the proliferative changes within the senile prostate, all credit for originality is, without question, due to Ciechanowski. In enlarged prostate, the new connective tissue, the contracted scar-tissue, and other signs of proliferation are seen most abundantly in the deepest portions of the gland, that is, midway between the periphery and the urethra, extending usually towards the urethra. There is, then, obstruction of exits, that is, of distal ducts, those nearest the urethra, and consequent retention of glandular secretion and other products of epithelial activity in the proximal or peripheral parts of the gland system. The obstruction is gradual, and at this period the muscular coat of each gland may hypertrophy to expel the glandular contents against opposition. Complete obstruction being established, passive glandular dilatation proceeds and general enlargement results.

When, now, atrophic prostates, that is, those below normal in weight, are studied [1, p. 282] unexpected and ample confirmation of this simple hypothesis of an almost mechanical method of production of prostatic enlargement is found.

Abnormally small prostates seem to be of two varieties. The first includes those which accompany lack of development or loss of the testes. In this variety the tubules are narrow, are only elemental in branching, and the epithelium is small and not active. The second variety of small prostate is found in old men where the testes are normal, and on section such prostates appear in many respects similar to the enlarged ones. The small round cells, the new connective tissue, the scar-tissue, and the amylaceous bodies are all present. The glands, on the other hand, are small and compressed. The new contractile tissue has formed round the primary acini, in other words, more in the periphery of the prostate. The glands at their origins are compressed; their secretion, far from being retained, is expressed, and the whole prostate diminishes in size.

It seems warrantable, with regard to *conclusions on the histogenesis of enlarged prostate,* to add such weight as I may, as have Greene and Brooks [27] recently, by reaffirming the conclusions of Ciechanowski:

"The so-called enlargement of the prostate, as well as certain forms of prostatic atrophy, are related histogenetically, and have a common cause. The two processes do not differ qualitatively, but only in the distribution, intensity, and localization of otherwise analogous changes.

"The common starting-point of the enlargement and certain forms of atrophy is to be sought in the productive connective-tissue processes which occur in the stroma, and according to the stage of their development can show different stages of repair, but are always in isolated masses, and principally arise directly under gland epithelium.

"If the stroma changes are located in the central prostate near the principal exits, the lumina are closed, secretion collects, and peripheral dilatation results. This dilatation is the more rapid and reaches a higher degree the more numerous and the nearer to the exits of the principal tubules the obstruction occurs, and also the higher the degree of the simultaneous intraglandular pathological processes. These consist mostly of active proliferation, followed by desquamation called catarrhal, and may end in a purulent process by the accession of leucocytes.

"The enlargement of the prostate is almost exclusively due to dilatation of glands. The new formed connective tissue is relatively unimportant, and the active participation of muscle tissue in enlarged prostate in the way of true myoma (great majority of cases) is unproved and doubtful.

"If the stroma changes take place principally in the periphery and near the blind ends of the tubules, then there is atrophy of the tubules, shrinking of the connective tissue in the stroma, and atrophy of the entire prostate. This is quicker and more intense if there is no endoglandular pathological process.

"According to the balance of these two processes, the prostate may be of normal weight, increased or diminished.

"Atrophy and enlargement are histogenetically and probably etiologically similar."

PART III.

ON THE CAUSE OF ENLARGED PROSTATE.

Since the earliest times, the distressing symptoms of enlarged prostate have been observed and their cause sought. According to Bernays,[8] the earliest mention of the prostate as the cause of many of the senile bladder symptoms was in the writings of Morgagni, printed in 1761. His opinion was corroborated by John Hunter in 1786, in his "Treatise on the Venereal."

It seems necessary, in considering the etiology of enlarged prostate, to take the space here first to summarize briefly the beliefs of the best observers on this subject, because even now widely divergent opinions are still held.

One of the earliest opinions seems at the present time, as is not infrequently the case, to be one of the best. Desault,[15] a follower of John Hunter, in 1813, first suggested the inflammatory origin of enlargement of the prostate, saying that it was common in those who have had many attacks of gonorrhœa.

Home,[38] about the same time, proposed as the underlying cause the habitual congestion of the parts about the bladder-neck, such as might be brought about in high livers or in people who sit much.

Mercier,[54] in 1841, considered the cause to be sluggish circulation of the parts, such as one expects in men with much fat, or with sedentary habits. Such men, he says, have relaxed veins and most often suffer from prostatic enlargement.

Astley Cooper,[13] in 1824, declared the affection was the result of age alone and only physiological. In this view many have concurred, particularly French writers. Thus, Launois,[43] Regnauld,[67] and Guyon [32] have all contended in recent years

FIG. 15.—Showing infiltration of fibrous tissue between the smooth muscle-fibres of enlarged prostate.

FIG. 16.—Showing diffuse, small round-cell infiltration and also arterio-sclerosis in a small vessel.

that prostatic enlargement is a senile involution in the physiological sense.

Next, there are many [4, 7, 19, 21, 26, 28, 36, 39, 44, 45, 49, 57, 58, 62, 77, 78, 79] who base their theories of prostatic enlargement in one way or another on the apparent parallelism of development and function between the prostate and the testes. Lydston [46] combines congestion with sexual "prostatic overstrain" as a cause.

Syphilis, gout, rheumatism, stone, and stricture have been considered among etiological factors, but are spoken of now only to be at once excluded, since the beginning of modern pathological histology.

The bearing of arteriosclerosis, local and general, and of bladder-wall changes, we have already considered at great length, and have decided that, as a constant etiological factor in the production of actual increase in the size of the prostate, it may be ruled out. It is seen in the enlarged prostate (Fig. 16) and in that of normal size.

Finally, there is the belief that the enlarged prostate is suffering from a true new growth,—single or multiple fibroma or fibromyoma. Of the adherents of this theory, the most prominent is Thompson, who says [72, p. 131, "Inflammation must be eliminated from the category of alleged causes," arguing that chronic inflammation would cause eventual shrinkage rather than increase in size. He draws an analogy, already referred to, between the uterus and the prostate as to their origin, and states that, just as at the close of functional activity, the uterus is liable to develop new growths similar in structure to its own, so in the prostate, at a similar stage of development in the male, a similar proneness to growths like itself in structure may be seen. Recent writers who still believe in the fibromyomatous prostate are few.[35] Maguire probably best summarizes their view when he says,[46] "Sometimes the obstruction is due wholly, or in part, to fibroma, single or multiple, of the prostate. They form distinct encapsulated growths. These tumors are like the fibromyomata of the uterus; of their etiology, I can offer you no conjecture."

As a last word in this list of hypotheses, it should be said that no one, so far as I can discover, still considers enlarged prostate to be a true hypertrophy.

It only remains, now, to discuss briefly in the light of modern pathology some of the more important theories in the list above.

1. The Relation of the Testes to Enlarged Prostate.—The theory of the dependence of enlarged prostate with its sequelæ on the testes is based upon (*a*) the parallel physiological development of the two; (*b*) on the arrest of development of the prostate after an arrest of testicular growth; (*c*) on atrophy of normal prostate after castration in animals and youths.

The observations on which this theory is founded are correct. There is undoubtedly in animals a near relation between castration or resection of the vas deferens and atrophy of the normal prostate. The histology of such prostate shows, as has been noted, a true atrophy of all elements. The supporters of the belief that prostatic enlargement, on the one hand, is due to a senile diminution of testicular function, and at the same time, on the other hand, advocate castration as a therapeutic measure to retard the enlargement, contradict their own observation. For [1, p. 288] as a proof of the correlation between the fact that castration causes prostatic atrophy as a result of the development of the prostate and the testes, they bring forth loss of sexual function; while in the same argument they declare that prostatic enlargement is due to some senile loss due to diminished testicular activity. In short, they contend that the original prostatic enlargement or the later diminution after castration are both due to loss of sexual function. This position is not tenable. Moses [59] reports enlargement of the prostate in a man of sixty-eight some years after a double complete castration, thus proving beyond doubt that the changes seen in enlarged prostate undoubtedly develop independently of the presence or absence of the testes.

White,[77, 78] Moullin,[57] and Harrison [36] have been the most ardent champions of a therapeutic application of this theory;

though I believe I am correct in saying that White no longer believes such an application to be uniformly indicated.[79] White's belief was based on experiments upon dogs, and since his first reports several [12, 45, 67] have worked on similar lines. It appears to be now established that in all animals except dogs castration is always followed by prostatic atrophy. In dogs, the results are variable; one case, for example,[45] five months after double vasectomy, showed a very large prostate. It is to be noted at this point that the dog, which is the only animal where prostatic atrophy does not always follow castration, is, according to the veterinarians [1, p. 290], the only animal that suffers from prostatic inflammation.

Cabot,[10, 11] too, entirely from the clinical point of view, has ably controverted the hypothesis of a connection between the testes and enlarged prostate. It is true that the prostate in the living, nothing being known of its histology, has without question, after castration, diminished in size. But it is also true that enlarged prostate is much more often seen in the living than it is found on the autopsy table. There is, in short, evidence that pressure, irritation, and inflammation at the bladder-neck produce their usual sequelæ of congestion, œdema, and even evanescent hyperplasia, and that these conditions may all be relieved and made less by the diminution of blood supply and by the functional inactivity which must follow castration. Indeed, the diminution in size follows too quickly to be a true tissue atrophy. Take, for example, a case operated by Gavin,[25] where the patient a few hours after castration passed urine voluntarily for the first time in months. Cabot says, "There are numerous cases in my practice in which removal of a stone had been followed by such subsidence of irritation at the vesical neck that no operation on the prostate was necessary;" and he, too, concludes that "no more wholly unsupported theory has been advanced in the whole discussion than that quick relief which sometimes follows castration is due to a rapid process of atrophy."

Englisch, in Vienna, is now making a physiological clin-

ical study of the relation between the prostate and testes, and Ciechanowski is also working on this problem.

2. Is Enlargement of the Prostate Neoplastic in Origin?—Beginning with Velpeau [73] and Thompson, those who believe the enlarged prostate to be a true new growth, usually fibromyomatous in character, are many, either by declaration or implication.

The facts that the prostate is purely a genital organ, as has been definitely established,[75] and that it contains the uterus masculinus, give ground for the reasoning that fibromyomata may arise in the prostate analogous to those found in the uterus.[35] Grossly, however, the largest prostate is only occasionally as large as the average uterine fibroid. Fibromyoma of the uterus, even the intramural form, may in most cases be sharply differentiated by the eye, at least, as a definite tumor. The prostatic tumor, if a fibroid, must be considered atypically diffuse. Microscopically, the myomatous part of the uterine fibroid is more cellular, and the nuclei are usually more uniformly distributed than in the prostatic tumor, that is, there are fewer of the hyaline fibrous areas resembling scar; and in the prostatic growth also, in practically every field, may be found the remains of at least one or more glands. Such glands, of course, are rarely seen in uterine fibromyomata.

In those prostatic tumors which most resemble fibromyomata (Fig. 15), careful study shows that the distribution of muscle-bundles is brought about, not by a new growth of them, but rather by subdivision and separation of old bundles due to the ingrowth and expansion of new connective tissue. It has been already shown, also, that the "knotty" form, where small round bodies resembling small fibroids shell out, is always glandular in its origin. Jones [39, p. 240] has never seen pure myoma of the prostate; Virchow [74] says it is very rare, and with this Motz [55, p. 254] agrees.

A recent study [3] of 100 prostates from men dead of prostatism showed fourteen cases said to be adenocarcinoma. This seems an undue proportion of true malignancy, and, so far as present figures go, can hardly be taken as an usual percentage.

It is to be concluded, therefore, that true fibromyoma as well as true adenoma may occur, but that neither is the condition found in the usual benign senile enlargement of the prostate.

3. Is Enlargement of the Prostate a Senile Involution?—The affirmative reply to this inquiry is not to be lightly cast aside. We have seen that there may exist a purely senile atrophy of bladder-wall muscle with a new growth of connective tissue infiltrating the muscles. Such a new growth of connective tissue may take place as part of a purely degenerative process, as is apparently seen in chronic mastitis and in chronic interstitial nephritis. Such connective-tissue formation following degeneration is accompanied by the presence of small, round mononuclear cells, and such tissue has also its characteristic power to contract and cause constriction. It is impossible therefore, at present, to exclude senile degeneration as one, at least, of the causes of enlarged prostate.

4. Is Enlargement of the Prostate Inflammatory in Origin?—The best work on this question has been done by Finger [22] and Ciechanowski,[1, 2] and from them I shall transcribe freely.

It has been the custom clinically to separate chronic prostatitis from senile enlargement; the principal ground for this being (*a*) that many individuals suffering from prostatism forget, truly or not, that they have had in the past an inflammatory affection of the urethra or prostate; (*b*) chronic prostatitis may be frequently differentiated in diagnosis from the commoner senile enlargement. This, however, as has been pointed out [1, p. 291] may well be only an example of the remote connection which may exist between the cause and the ultimate appearance of a disease. That is, this latent relation between infection and senile enlargement may be similar to the apparently undoubted connection between syphilis and the later central nervous affections, or the relation between rheumatism and the chronic valvular cardiac disease discovered many years later; (*c*) the objection of Thompson that inflammatory disease should cause shrinking rather than enlargement has

already been met by showing that the essential change is a shrinking, but that the shrinking may be about exit-ducts and be followed by proximal gland dilatation. It may be, in fact, compared to the constriction of the pylorus which is followed by dilatation of the stomach. Furthermore, infectious processes may be the basis of increase in volume of tissue, as witness thickenings of the pleura, infectious granulomata, the development of tuberculous tissue, and others. Finger (loc. cit.) concludes that the changes of chronic prostatitis are identical with those of senile enlargement. In both there is a catarrhal gland inflammation, a subepithelial, periglandular, round-cell infiltration, and in both the process is in clumps and irregular in distribution. The importance of such differences in intensity and distribution of the inflammation, that is, quantitative differences between prostatitis and enlargement, lies in the fact that they explain differences in clinical symptoms between the two. The amount and intensity of inflammation particularly explain the late and slow onset of enlarged prostate, it being fair to conclude that the latter is always the result of an infection long latent and of such slow onset that the infection may indeed be forgotten. In both processes, described clinically as chronic prostatitis and enlarged prostate, the beginnings seem always to be in and about the glands and ducts and not near vessels; in other words, they are both ultimately of urethral and not of hæmatogenous origin.

The underlying inflammation is, of course, gonorrhœa. That an attack of this infection should not be remembered is, as a matter of fact, unnecessary. Patients in whom strictures are found [1 p. 296] will declare they never had gonorrhœa or instrumentation. Many observers [30, 60, 63] quoted by [1] have proved that gonorrhœa may be primary in the prostate, and others [20, 23, 31] have shown that the disease may remain in the posterior urethra for a long time latent and quite unsuspected. Posterior urethritis is said by some [9] to occur in 93 per cent. of cases with anterior urethritis, and in many of these cases there is a definite prostatitis.

The direct proof of finding gonococci in the sections of

enlarged prostate remains unmade. Councilman[14] first demonstrated their presence in the prostate, and others[60] have shown them to be present in prostatic milkings. These instances, however, were in fairly acute inflammations; and, if it were difficult here, it is little wonder that they may not have been found in such a chronic and such a mild process as the senile enlargement.

Ciechanowski collects certain indirect facts which tend to confirm belief in the corelation of gonorrhœa and the enlarged prostate.

(1) The frequency of gonorrhœa;

(2) The frequency of chronic gonorrhœa in the posterior urethra and prostate, *i.e.*, in 1070 cases[70] the process was in the deep urethra in 424;

(3) The frequency of cystitis; and, lastly,

(4) The only domestic animal that suffers from enlarged prostate is the dog; and the male dog, too, seems to be the only animal that has a true purulent urethritis which is infectious.[41]

Kryzysztalowicz[1, p. 299] collected 121 strictures in ninety-nine persons, of whom sixty had suffered from long-standing gonorrhœa, and five still had it; ages between forty and sixty years. Most of them first showed demonstrable signs after fifty years of age. This proves that often many years may elapse after the chronic gonorrhœa before stricture appears; that gonorrhœal infection, in other words, may be latent and forgotten for many years and yet be potent.

And, finally, as Ciechanowski[1, p. 300] has made perfectly clear, a characteristic of the advance of a gonorrhœal process is that it is not by continuity but by jumps, and the distribution of diseased foci separately here and there over the prostate is distinctly a feature in senile enlargement.

From this review, therefore, I make the following CONCLUSIONS ON THE CAUSE OF ENLARGED PROSTATE:

(1) The underlying cause of the usual form of prostatic enlargement and of certain forms of prostatic atrophy is a slow formation of new connective tissue due to infection or to infection aggravating a senile degenerative process.

(2) The gonococcus is probably most often the specific infection because (*a*) of its great frequency; (*b*) other inflammatory causes are not common in the parts in question; (*c*) a great similarity exists between the histology of gonorrhœal processes and those seen in these senile prostates.

(3) Neoplasms, fibromyomata, and adenoma occur, but may be called rare.

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REMOVAL OF AN UPHOLSTERER'S TACK FROM THE RIGHT BRONCHUS.

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THE technical difficulties encountered in the location of metallic foreign bodies within the economy have been materially lessened by the use of the X-ray. From an experience acquired in taking several hundred radiograms and in the routine use of skiagraphic examinations in my practice, I am convinced of the great value of the X-ray in more than one department of medicine; and the following case, as illustrative of the utility of this agent in the field of physical diagnosis, for the certain and absolute localization of foreign bodies, is not without value.

On the evening of February 15, 1902, R. S., aged eight years, while playing around her home, carried in her mouth an ordinary umbrella-headed upholsterer's tack, and in some manner let it slip back into the pharynx and, as it eventually proved, through the larynx into the trachea, finally lodging in the right bronchus. The attention of the mother was attracted by the strangling and coughing of the child; and after shaking and inversion had failed to expel the tack, a physician was summoned, who, thinking that the tack might have lodged in the œsophagus, had the child swallow some dry bread in an effort to clear the œsophagus. Nothing further was done at the time.

The child became very hoarse and a rattling noise could be heard in her throat; that night she was very restless, and the next morning she had a severe spell of coughing, which so exhausted her that she fell asleep again and slept for several

hours. During the four days that followed the accident the child's breathing was rather heavy and the rattling noise in her throat was still present; on the fourth day, however, she coughed up some mucus and blood, and with this the hoarseness and rattling disappeared.

Five days after the accident the child was taken to a physician, who, by means of the X-ray, located the tack in the trachea just at the bifurcation, but no attempt was made to remove the tack.

On March 10 the child was brought to me. The mother said that every morning and evening the child had a paroxysm of coughing, so severe as to completely exhaust her, but during the day she had only a slight hacking cough. Since the accident her temperature had ranged from 100° to 103° F., and her loss in weight had been constant, amounting in the aggregate to about ten pounds, according to the estimate of the mother. The child was drowsy and slept soundly at intervals.

When the child was brought to me I made a skiagraphic examination and took a radiogram of the child's chest. With the fluoroscope the tack was readily located in the right bronchus, and the accompanying radiogram will show the tack *in situ*.

On March 14 the child entered St. John's Hospital, and on the following morning, under a general anæsthetic, a low tracheotomy was made, the innominate artery being in evidence in the lower angle of the incision. On opening the trachea a large quantity of muco-pus was expelled. After cocainization of the tracheal mucosa, a large endoscopic tube was introduced and an attempt made to locate the tack by reflected light, but, owing to the blood and muco-pus which were present, the tack could not be seen. A pair of flexible laryngeal forceps with an elbow to seize the tack, which had been selected by Dr. W. E. Sauer, who was associated with me in the case as a laryngologist, was then introduced through the tube, and an effort made to find and grasp the tack; but unfortunately the child became very cyanotic, and it was thought best not to make any further attempts at removal for the present. The child recovered from the operation very nicely.

The tracheal wound was left open with the idea that the tack might be expelled spontaneously; but, though the severe coughing spells continued and a large amount of muco-pus was

FIG. 1.—Showing tack in right bronchus.

FIG. 2.—Position in which child was placed to introduce the endoscopic tube.

expelled, the tack remained in the bronchus. The trachea wound closed spontaneously about six days after the operation.

On March 20 the child was again given an anæsthetic, and, in addition, the trachea was thoroughly cocainized and swabbed out with a solution of adrenalin. A powerful electro-magnet, which had been very ingeniously contrived under the direction of Dr. I. P. Chandeysson, was then introduced through the tracheal wound and carried down into the bronchus in an effort to find and withdraw the tack; and, although the tack could be felt with the magnet, it was too firmly embedded to be withdrawn by this means.

The large endoscopic tube was then introduced into the trachea, and, taking advantage of the mobility of the trachea in the patient, carried down into the right bronchus, but upon examination with reflected light the tack could not be seen because of the accumulation of mucus in the bronchus. The laryngeal forceps used in the first operation was again inserted through the endoscopic tube, and the tack was felt and grasped, but so firmly embedded was it that several times the hold of the forceps was broken. We found that the head of the tack was larger than the lumen of the tube through which we were working, and when, at length, a firm hold on the tack was secured, the tube and the forceps were withdrawn simultaneously. Considerable hæmorrhage followed the removal of the tack, owing to the tearing of the mucosa in pulling the tack along the passage. A tracheotomy tube was introduced, and the child put to bed.

With the exception of a slight rise in temperature four hours after the operation, the child had no fever. For a few days after the operation a good deal of mucopurulent secretion was coughed up, but this gradually disappeared, and an uneventful recovery followed. On March 31 the child left the hospital.

LANDMARKS IN THE URETER.

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General Remarks.

The data of the following article are based on the investigations of over 100 ureters of man, ape, monkey, dog, cat, rabbit, horse, cow, pig, sheep, leopard, and fish. The ureter was distended with air, fluid-melted paraffin, red lead, and starch, and finally X-rayed as a model for drawing. Ureteral dissection was practised to confirm data.

Surgery is the father of anatomy. Previous to the demonstrated utility of ureteral surgery, the practical anatomy of the ureters remained unknown precisely similar to that of the utero-ovarian artery. My experience in gynæcology with special regard to relation of the ureter and the utero-ovarian vascular circle, and particularly the advance in the diagnosis of ureteral disease by the aid of the X-ray, induced me to make a special study of the anatomy and physiology of the ureter (chiefly in the female) for practical and surgical purposes. The ureter is significant in abdominal and pelvic surgery, but it is of special practical importance in its relation to the pelvic-floor segment of the utero-ovarian artery at the distal arterio-ureteral crossing.

The ureter is not a straight, uniform calibered tube, but consists in general of three constant dilatations (reservoirs, spindles), three constant constrictions (sphincters, isthmuses), and three constant flexures (curves),—all of which are important in practical surgery.

Causes of the ureteral dilatations: the ureteral pelvic dilatation is due to a flexure, kink, of the ureter (neck) caused by a medialward projection of the distal renal pole; the lumbar dilatation (spindle) is due to the bending of the ureter over the iliac artery resulting from the erect attitude (man and ape); quadrupeds do not possess this ureteral spindle or dilatation. The pelvic dilatation (spindle) is due to resistance of the valve in the bladder-wall. The flexures of the ureter produce the ureteral isthmuses or sphincters, and these constrictions cause ureteral dilatations. The constrictions in the ureters obstruct calculi. The X-ray demonstrates that more calculi are found in the ureter than in the kidney. The calculi will lodge at the points of narrowest caliber of the ureter which are in order, perhaps; (*a*) the proximal isthmuses (neck); (*b*) the distal isthmus or vesical ureteral orifice, and (*c*) the middle ureteral isthmus at the iliac flexure. The ureter, consisting of calices, pelvis, and ureter proper, is as independent an organ as the heart, uterus, or lung. It is not a passive organ. It is an active, rhythmical viscus, dilating and contracting like the uterus, heart, and lung. Its complete single rhythm (dilatations and contractions), extending from calices to bladder, occupies, perhaps, five minutes. Urine passes from kidney to bladder by ureteral rhythm, peristalsis, not by attitude or force of gravity. All late developed organs are frequently subject to anomalies. The ureter is the third renal duct arising from the Wolffian body, and hence has numerous anomalies, especially extra mucal valves, and consequent irregular dilatations. The proximal end is especially liable to irregularities.

To record accurately the views acquired by the investigation of the ureter and to facilitate the comprehension of ureteral relations, sphincters, dilatations, curves, and new nomenclature, we present a number of illustrations based on the solid ground of nature.

The ureter, a urinal transporting organ, lies interpolated between kidney and bladder. It is a rhythmical, active, independent, not a passive organ. The ureter is not only a transporting urinal duct, but it is also a urinal reservoir exactly

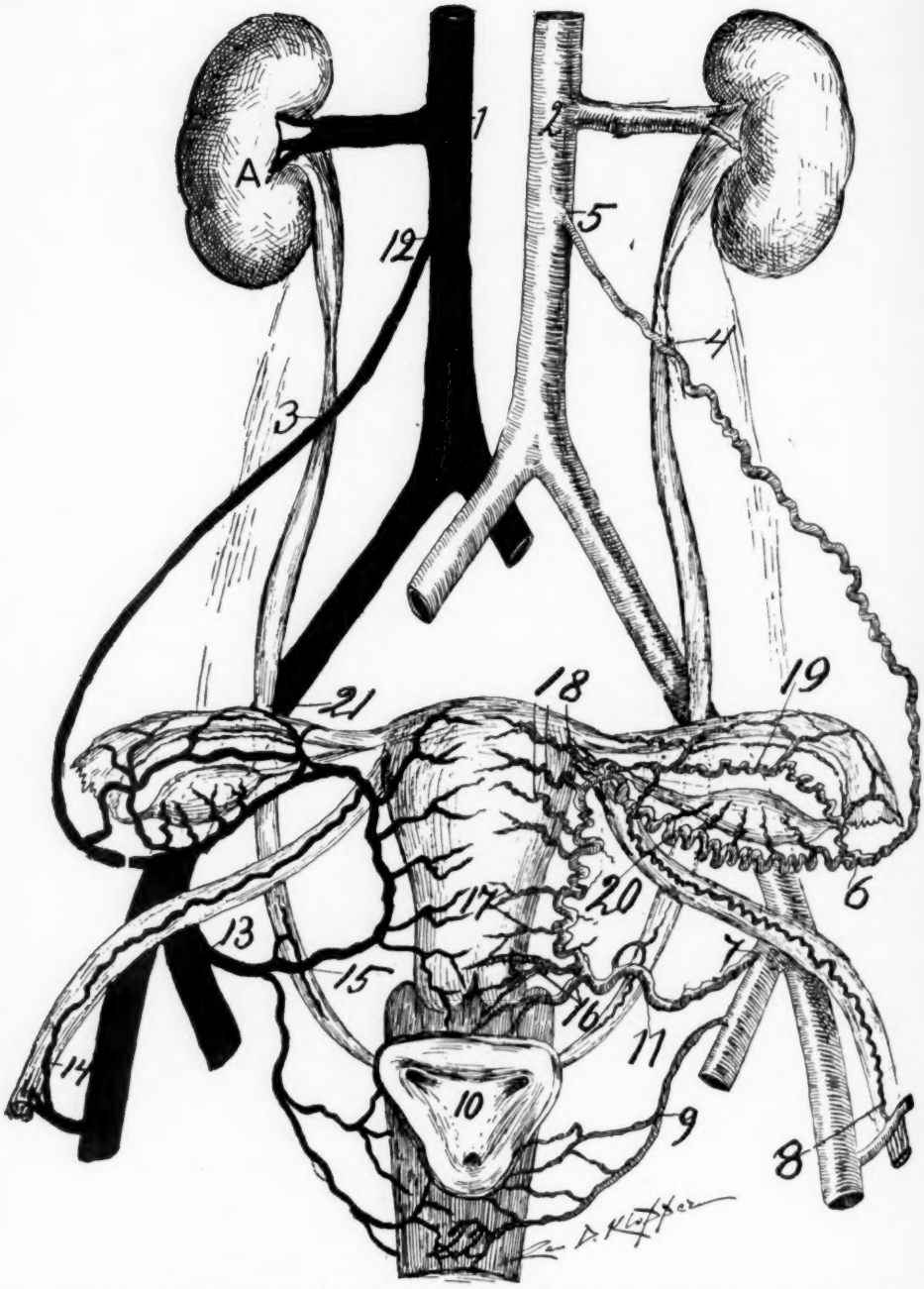


FIG. 1.—Ureteral relations to the tractus genitalis and to the utero-ovarian vascular circle. 7. Origin of arteria uterina. 11. The distal arterio-ureteral crossing (with its arteria ureterica). 21. Middle arterio-ureteral crossing. 3 and 4. Proximal arterio-ureteral crossing (where there is a constant arteria ureterica). On the right side is the uretero-venous triangle of author (3, 12, 11). Trigonum vesicæ, 10.

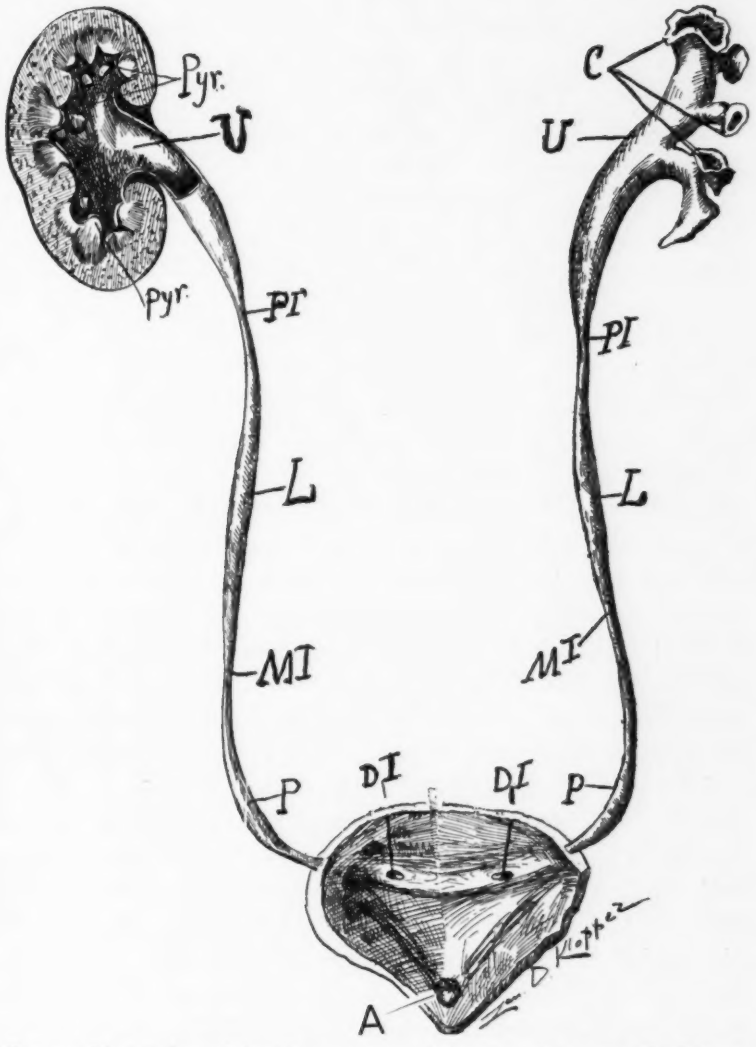


FIG. 2.—Illustration of female ureters in their natural course. C. Calices, with their major proximal and distal arms. U. Ureteral pelvis (reservoir). PI. Proximal isthmus (ureteral neck). L. Lumbar spindle (reservoir). MI. Middle isthmus, sphincter. P. Pelvic spindle. DI. Distal isthmus, sphincter. Pyr. Renal pyramids. The trigonum vesicæ is plainly visible, DI. DI. A.

similar to the bladder, which is periodically rhythmically distended and contracted. The ureter is a segment of a perfect system of water-works, of which the reservoirs and stop-cocks are always full and in order. The ureter fills and empties its contents by rhythmical waves regardless of attitude. The capacity of the ureter (calices and pelvis) in some cases is about an ounce. The muscularis of the ureter (tractus urinarius) consists of several, generally three, irregular layers resembling the three irregular muscular layers of the tractus genitalis (oviducts, uterus, vagina). The muscularis of the tractus intestinalis consists of two constant muscular layers, an internal circular and external longitudinal muscular layer.

The ureter resembles a river whose contributory arms or calices collect the fluid from different regions of the kidney to merge into the main stream bed, the ureteral pelvis, whence the ureter conducts it to the bladder. The urine is continually prepared and secreted by the kidney, but the ureter (a reservoir) conducts it to the bladder (a reservoir) periodically only, when the ureteral calices and ureteral pelvis are filled, *i.e.*, by ureteral rhythmical waves. The ureters are distensible but slightly elastic. In the cadaver they will distend, but not recover their form, by elasticity. Intimate fixed connections of the ureter with any organ do not exist except with the kidney and bladder. It is fixed slightly by some fibres to the peritoneum. The distal and proximal extremities of the ureter are located in vast beds of areolar tissue,—important for mobility and surgical intervention. The ureters are soft organs and not easy to feel. The defects in the ureters lie either in the obstruction of the urinal stream (mechanical, kink, stricture, calculi) or in their peristalsis (paralysis of inflamed wall). A ureter being considerably longer than the distance between the proximal and distal extremities, and lying in a universally loose matrix of areolar tissue, can be lifted several inches from its bed, drawn through an abdominal wound or forced aside by pathologic processes, without loss of integrity. All surgery on the ureter should be executed as near the ureteral reservoirs as possible, on account of large caliber and ample ureteral wall.

In special relations of the ureters, the left ureter, on account of its nearer approach to the middle line, lies closer to the cervix uteri and to the aorta. The more distal the uterus the closer are the ureters to it; hence, in vaginal hysterectomy, to avoid ureteral trauma, the ureters should be forced ventrally and proximally by cleaving the bladder from the uterus. The filling of the bladder separates the ureters, removes them from the ventral pelvic wall, and forces them proximalward. Under some circumstances the ureter may be palpated through the vagina, rectum, or on the iliac vessels. The ureter should be sought on the ventral vaginal wall from the proximal end of the columna vaginales to the ventral vaginal wall. Through the rectum one seeks the ureter between the lateral pelvic wall and lateral vaginal fornix.

The following table of ureteral function and structure will facilitate the comprehension of the field of the ureter in the individual economy.

FUNCTION.

- I. Tunica Mucosa.
  - 1. Secretion.
    - *a*. Beaker cell (?).
    - *b*. Glands, crypts (?).
  - 2. Absorption.
- II. Tunica Muscularis.
  - 1. Peristalsis (rhythm).
    - *a*. Muscular contraction and relaxation.
    - *b*. Rhythmical ureteral waves.
- III. Tunica Fibrosa.
  - 1. Distributing medium.
    - *a*. Blood-vessels.
    - *b*. Lymph vessels.
    - *c*. Nerves.
    - *d*. Ganglia.
  - 2. Elastic medium,—areolar cushion.
  - 3. Fascial fixation apparatus.
  - 4. It lies in planes of subserosa.
- IV. Tunica Serosa (Partial).
  - 1. Absorption.
  - 2. Secretion.
  - 3. Facilitates motion.
  - 4. Fixation apparatus.

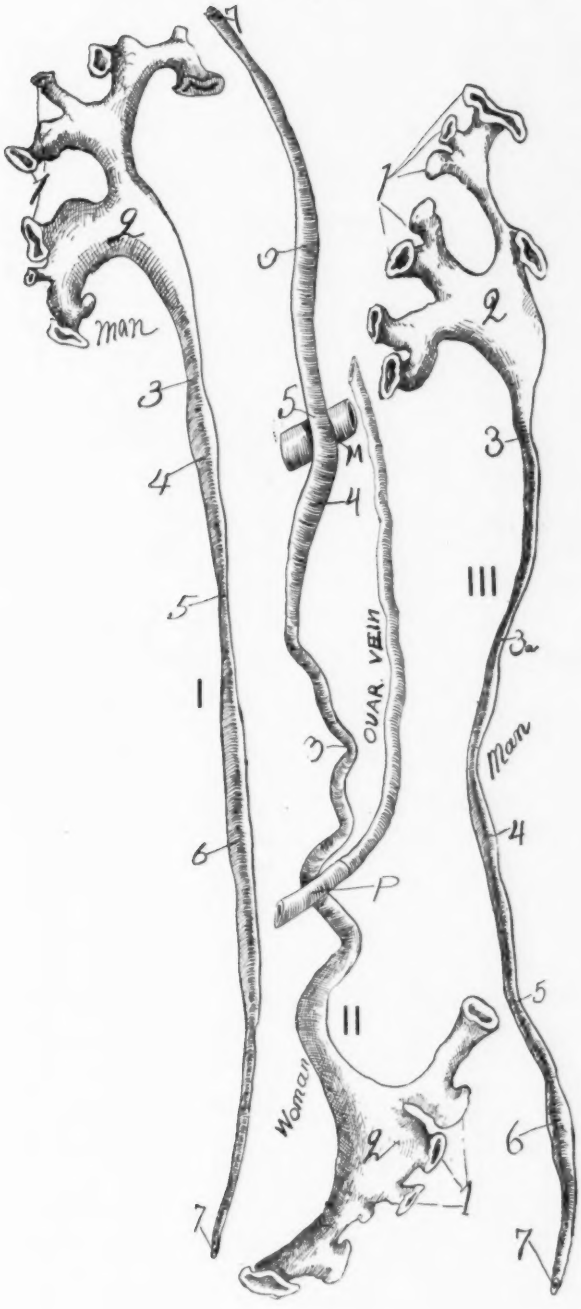
(The general function of the ureter is peristalsis, absorption, and secretion.)

FIG. 3.—As the ureteral calices, pelvis, isthmuses, reservoirs, spindles, and arterio-ureteral crossings of each drawing are numbered alike, one description suffices for all.

1. Ureteral calices. 2. Ureteral pelvis (reservoir). 3. Proximal ureteral isthmus, sphincter, or neck. 4. Lumbar spindle (urinal reservoir). 5. Middle isthmus, sphincter (flexura iliaca ureteris). 6. Pelvic ureteral spindle (reservoir), generally two, marked 6 and 6a. 7. Distal ureteral isthmus, sphincter, or distal ureteral orifice. M indicates the point of the ureter crossing the iliac artery—middle arterio-ureteral crossing. P notes the proximal and Q (a) the distal arterio-ureteral crossing. Unless otherwise stated, the ureters were removed from the cadaver with the dorsal tissue, vessels, kidneys, and internal genitals in order to retain natural relations; after which I injected ureters and vessels with red lead and starch of similar consistency and under similar pressure. The specimens were then X-rayed in Dr. Harry P. Pratt's X-Ray and Electro-Therapeutic Laboratory. Dr. Wm. E. Holland magnified the X-ray three times the original or natural size of the specimen, when my artist, Mr. Zan D. Klopper, sketched from this as a model. The illustrations accompanying the article are, except when noted, reduced to seven inches long,—one inch over half-life size.

FIG. 3 presents three isolated ureters. Note the wide range of variation not only in the calices, the proximal and distal arms, but the irregular ureteral spindles and isthmuses.

FIG. 3.



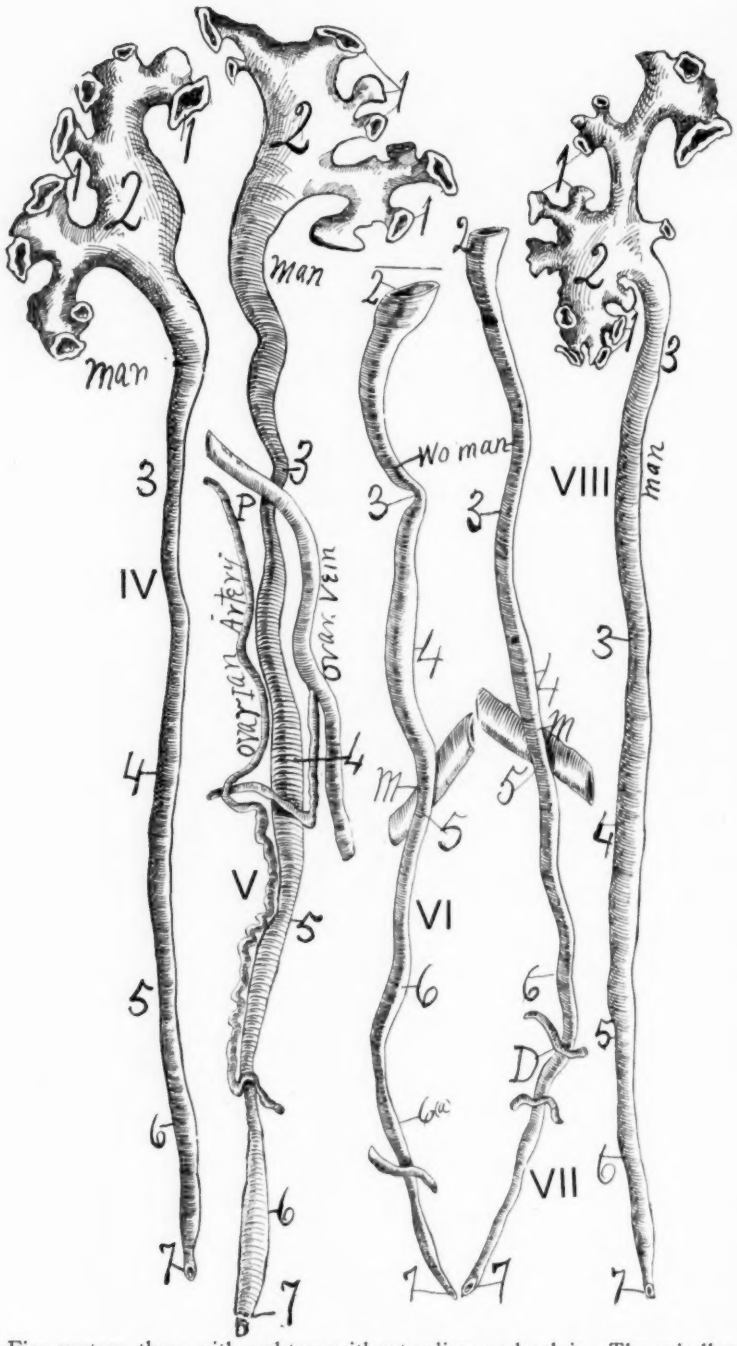


FIG. 4.—Five ureters, three with and two without calices and pelvis. The spindles are obvious, especially those of the woman at 4 and 6. There frequently exist two pelvic spindles, 6 and 6a. VI and VII are ureters from the same subject in their natural course relations. Observe the variation in ureteral calices and pelvis. The major distal arm of the calices is practically a lateral tributary, while the major proximal arm of the calices is the principal in direction; however, the proximal arm generally has one or two less calices.

STRUCTURE.

I. TUNICA MUCOSA. EPITHELIUM.
1. Form, transitional.
2. Layers,—multiple, usually three.
3. Shape,—cylindrical (flat), polyhedral, cubical, oval.
4. Nucleus,—oval.
5. Beaker cells (?).
6. Glands, crypts (?).
7. Lies in longitudinal folds.

II. TUNICA MUSCULARIS.
1. Internal longitudinal layer.
2. External circular layer.
3. Irregularly directed muscular bundles.
4. Ureteral fibromuscular sheath.
5. Numerous lymph, large blood-vessels (especially veins) exist in this coat.

III. TUNICA FIBROSA.
1. Areolar tissue (fat).
2. Fascial fibre.
3. Elastic fibre.
4. Chief location of main ganglia and nerve cords.
5. The fibrous tissue of the ureter (like that of the genitals) possesses large veins.

IV. TUNICA SEROSA (PARTIAL).
1. Endothelium.
2. Stomata vera.
3. Stomata spuria.
4. Interendothelial line.

(General structure: (*a*) mucosa; (*b*) muscularis; (*c*) fibrosa.)

Object.—A transporting urinal duct from kidney to bladder.

Accessory Glands.—Crypts, glands(?).

Composition of Secretions.—Mucus, fluid.

Nerve Apparatus.—The ureter is supplied by 1. Plexus renalis and 2. Plexus ovarica, chief supply to the proximal ureter. 3. Plexus hypogastricus and 4. Plexus vesicalis, chief supply to the distal ureter. 5. The main nerve supply of the ureter is from the sympathetic; hence the ureter is an active rhythmical organ, as sympathetic nerves alone produce rhythm. 6. The large sympathetic nerve ganglia reside in the tunica fibrosa ureteris. 7. Non-sympathetic nerves also are found in the ureter. 8. The main nerve supply of the ureter is found along the ureteral blood-vessels, and is designed to innervate the tunica muscularis. 9. A nerve net-work surrounds the ureter.

Vascular Apparatus.—(A. Arteries.) The ureter is supplied by the following arteries, viz.: 1. Arteria renalis; 2. Arteria ovarica (Arteria ureterica proximal); 3. Arteria

iliaca (Arteria ureterica media); 4. Arteria uterina (Arteria ureterica distal); 5. Arteriæ vaginales; 6. Arteria hæmorrhoidalis media; 7. Arteria vesicalis inferior; 8. Arteria nutrientia pelvis.

(B. Veins.) The ureter is drained by the following veins: 1. Plexus venosus renalis. 2. Plexus venosus ovarica. 3. Branches to vena iliaca. 4. Branches to vena hypogastrica. 5. Branches to plexus venosus vesicalis. 6. A net-work of large vein lies in the tunica fibrosa ureteris.

Lymph Apparatus.—Little is known of the lymph apparatus of man's ureter. Krause, 1876, makes a statement that there is a lymph net-work in the ureteral mucosa. Perhaps the space between the extra distal muscular ureteral sheath and ureter proper is of a lymphatic character.

The segments of the ureter are significant for detailed views and surgical intervention.

SEGMENTS.

- I. Anatomic and Physiologic.
  - 1. Ureteral calices.
  - 2. Ureteral pelvis.
  - 3. Ureter proper.
- II. Regional.
  - 1. Pars abdominalis.
    - *a*. Pars renalis or adrenalis.
      - *A*. Ureteral calices.
      - *B*. Ureteral pelvis.
    - *b*. Pars infrarenalis or pars lumbalis.
  - 2. Pars iliaca (flexura iliaca ureteris).
  - 3. Pars pelvina.
    - *a*. Pars parietalis (fixed).
    - *b*. Pars vesicalis (mobile).
      - *A*. Pars extramuralis.
      - *B*. Pars intramuralis.
- III. Surgical.
  - 1. Dilatations (reservoir, spindles).
    - *a*. Ureteral pelvis (proximal).
    - *b*. Lumbar spindle (middle).
    - *c*. Pelvic spindle (distal).
  - 2. Constrictions (isthmuses, sphincters).
    - *a*. Proximal (neck).
    - *b*. Middle (iliac).
    - *c*. Distal (vesical).
  - 3. Flexures (curves).
    - *a*. Flexura renalis (due to distal renal pole).
    - *b*. Flexura iliaca (due to iliac vessels).
    - *c*. Flexura pelvina (due to pelvic organs).

Fixation Apparatus.—The ureter is fixed by (1) the kidney; (2) the bladder; (3) by a universal loose bed of areolar and fascial tissue; (4) the peritoneum; (5) blood-vessels and nerves; (6) adjacent viscera; (7) intra-abdominal pressure. An intimate fixation apparatus of the ureter does not exist except at the kidney and bladder. The ureter is a mobile, shiftable, extraperitoneal organ universally loosely embedded in the dorsal subserosum. The ureter being longer than the distance between kidney and bladder, also lying in a loose, mobile bed, it may be drawn through an abdominal incision without injury.

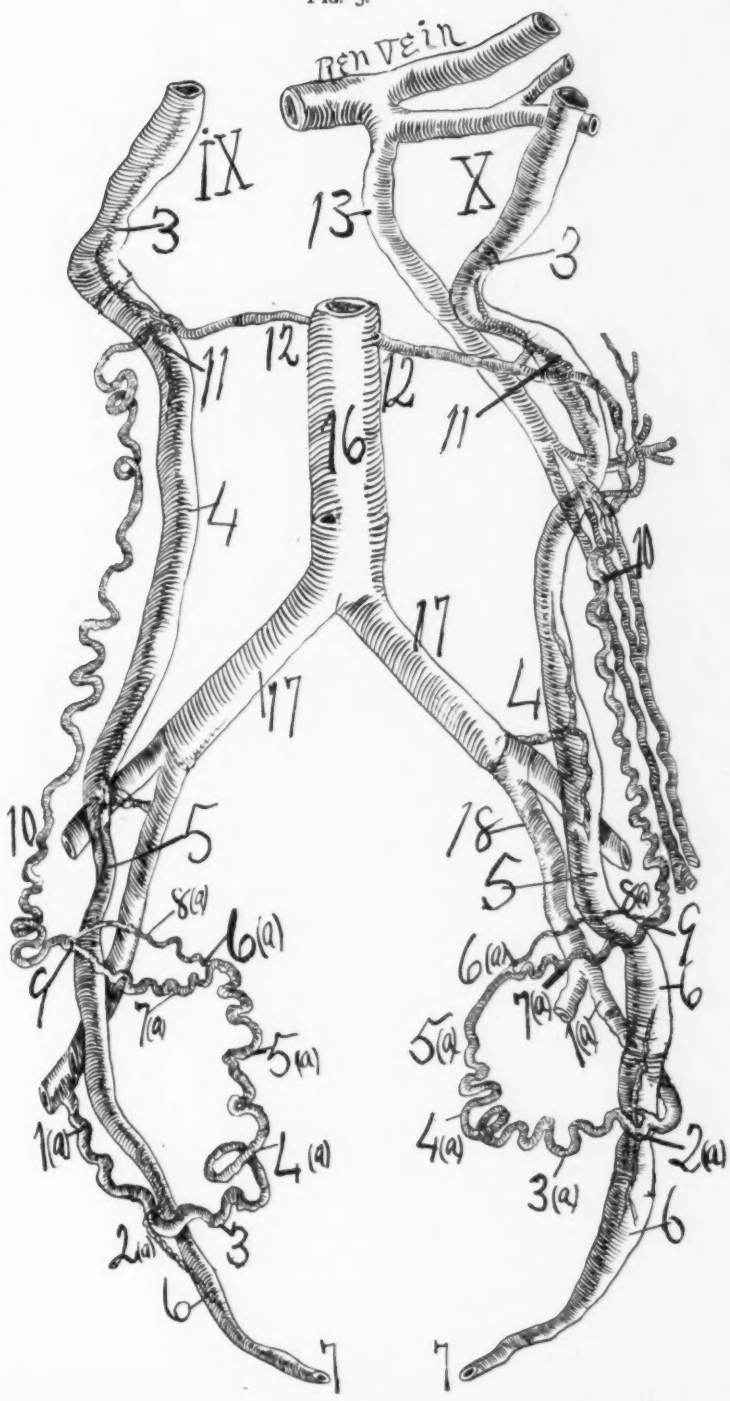
Walls.—(*a*) Ventral; (*b*) Dorsal; (*c*) Lateral.

DIMENSIONS.

1. Length.	male	11½ inches.
	female	11 inches.
2. The left ureter is about one-half of an inch longer than the right.		
3. Distance.	(*a*) between ureteral pelves	4 inches.
	(*b*) (maximum) between pelvic ureters	4½ inches.
	(*c*) between distal ureteral orifices	1 inch.
4. Distance between ureters at the arterio-ureteral crossings.	(*a*) Proximal	3½ inches.
	(*b*) Middle	2½ inches.
	(*c*) Distal	2½ inches.
5. Diameter (isthmuses, sphincters).	(*a*) Proximal	½ inch.
	(*b*) Middle	¼ inch.
	(*c*) Distal	1/10 inch.
6. Diameter (reservoirs).	(*a*) Ureteral calyx	¼ inch.
	(*b*) Ureteral pelvis	½ by 1½ inches.
	(*c*) Lumbar spindle	⅓ inch.
	(*d*) Pelvis spindle	¼ inch.
7. Distance of ureter from cervix uteri		½ inch.
8. Distance between ureters at os internum uteri		2½ inches.
9. Distance between hilus renis to proximal isthmus		½ to 4 inches.
10. Distance (minimum) between ureter and rectum		¼ inch.
11. Distance between ureters at os uteri externum		2 inches.
12. Distance between ureters on entering bladder		1½ inches.
13. Length.	(*a*) Pars abdominalis	5 inches.
	(*b*) Pars iliaca	1 inch.
	(*c*) Pars pelvina	5 inches.
14. Length.	(*a*) Lumbar spindle	1 to 3 inches.
	(*b*) Pelvic spindle	½ to 1½ inches.

FIG. 5.—Ureters in relation to utero-ovarian vascular circle, 1 (a), 2 (a), 3 (a), 4 (a), 5 (a), 6 (a), 7 (a), 8 (a), 9, 10, 11, 12. At 2 (a) the distal arterio-ureteral crossing the distal arteria ureterica passes from the arteria uterina to supply the ureter. IX and X from the same subject. At 11, the proximal arterio-ureteral crossing, the ovarian segment emits the proximal arteria ureterica to supply the ureter, the arteria ureterica having age and functional relations, its lateral branches will also possess age and functional relations, consequently the walls of the ureter at the arterio-ureteral crossing will possess age and functional relations, and hence suffer in nourishment and dilate in climacterium and senescence. The ureters show different sized dilatations and sphincters in this subject. Both ureters cross the common iliaces at the middle arterio-ureteral crossings, which of course will show no recognizable age and functional relations. 13. Ovarian vein. No. X presents the uretero-venous triangle of the author by means of the ovarian vein (13, 11), ureter (11, 3, to kidney), and the renal vein. X shows wide spindle dilatations.

FIG. 5.


Ren vein
IX
X
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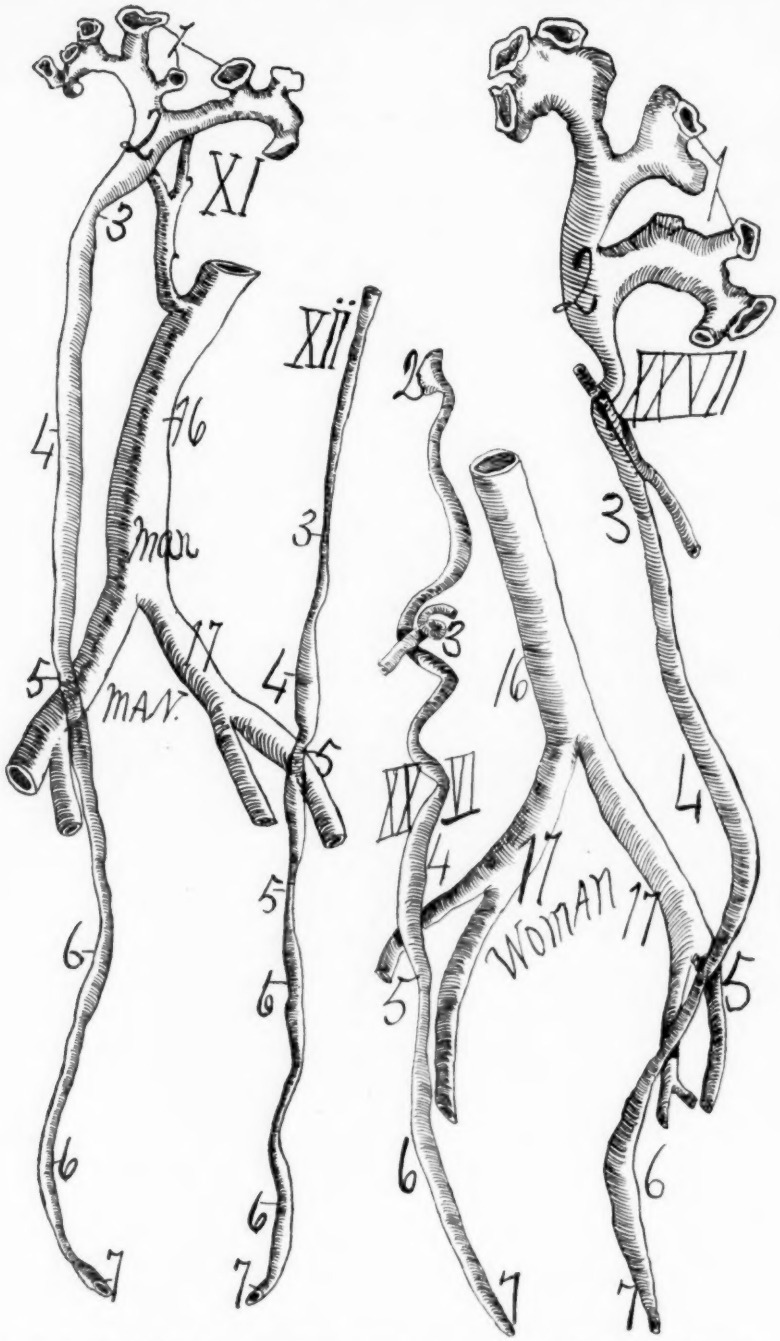

FIG. 6.—Nos. XI, XII are from the same subject as are XXVI and XXVII. The spindles in the same subject differ in size and location in each ureter, but they are governed in general by the original isthmuses; however, the ureter being in a loose bed, and gaining its adult location by a long route from the lumbar to the pelvic region, experiences many anomalies and changes. Note the long ureteral spindles at 4 and 6, XXVII (woman).

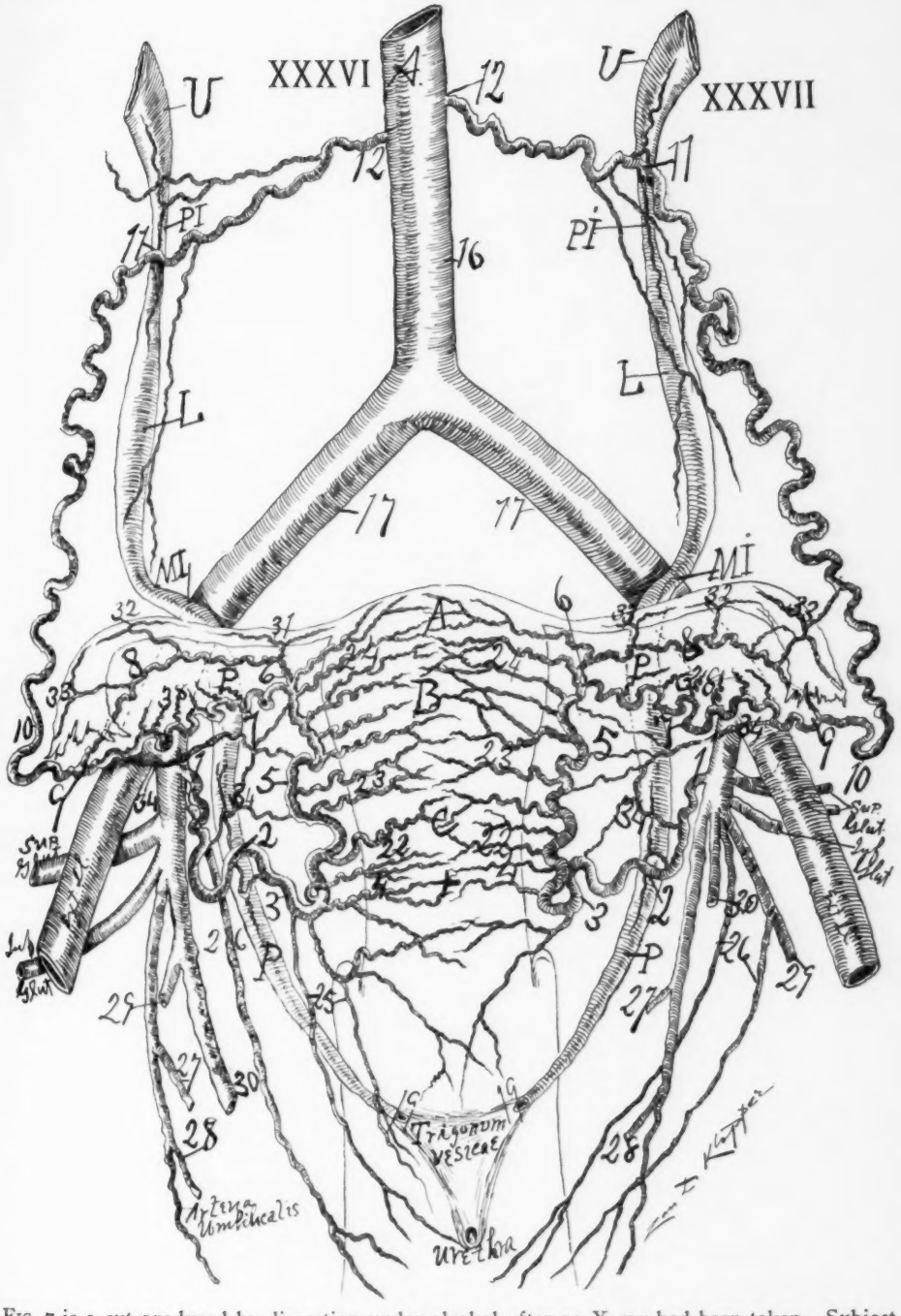

FIG. 7 is a cut produced by dissection under alcohol after an X-ray had been taken. Subject about forty-five years. Ureteral spindles and isthmuses distinct and in usual location. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, spiral segment of the utero-ovarian or genital vascular circle. The important proximal (11) and distal (2) arterio-ureteral as well as the cervical loop (2, 3, 4).

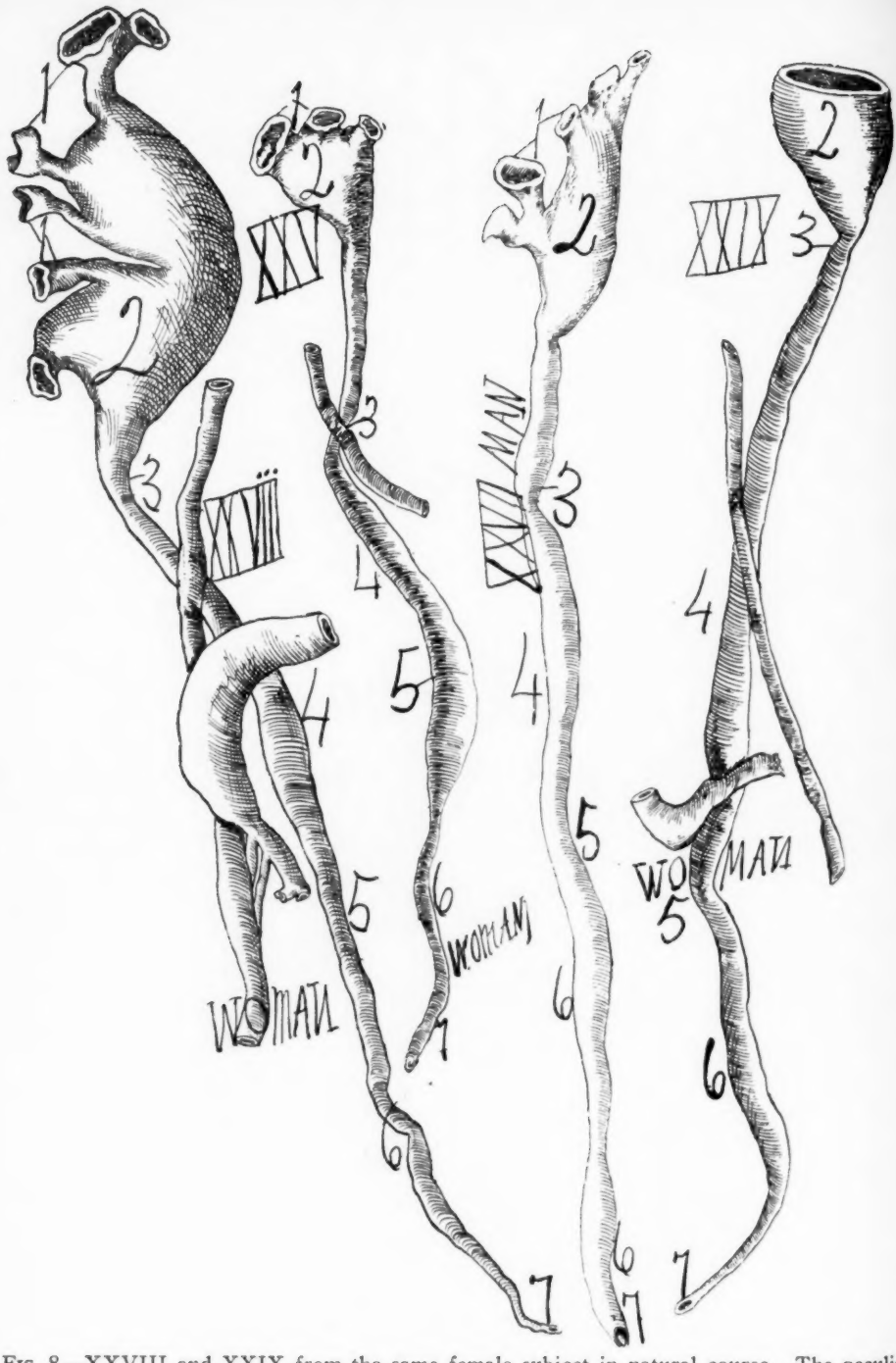

FIG. 8.—XXVIII and XXIX from the same female subject in natural course. The peculiar shaped calices and pelvis attract attention. Note the arterial ovarian segment, especially the large venous ovarian segment on No. XXVIII at 4. No. XXV, a woman, shows pronounced spindles and isthmuses. 3. Proximal arterio-ureteral crossings. No. XXVII, a man, shows two pelvic spindles.

The dimensions of the ureter are variable. The length lying in the body *in situ* is shorter than it is extirpated and extended. The diameters and locations of the ureteral isthmus or sphincters vary within wide ranges. The capacity and locations of the ureteral reservoirs vary within an extensive zone.

Matrix. (Tissue bed.)—1. The ureter lies in a universally loose areolar and fascial bed. 2. It is located immediately extraperitoneal and is loosely attached to it by fibres. 3. The ureteral bed allows not only the constant periodic rhythmical wave or peristalsis of the ureter, but wide range of motion without trauma or altering its integrity. 4. The bed of the pars lumbalis is the ventral surface of the psoas muscle, which doubtless aids ureteral peristalsis by its contraction and relaxation. 5. The bed of the pars iliaca is the vasa iliaca whose contraction and dilatation (rhythm) also aids ureteral rhythm. 6. The pars pelvina has a more fixed bed with less rhythmic adjacent organs. 7. The loose yielding ureteral bed allows the ureter to be drawn extensively from its bed for surgical intervention or to be forced from its bed by pathologic processes. The pars vesicalis is the most mobile segment.

Position.—The position of the ureter should be considered in relation to (*a*) the general body, (*b*) in relation to the osseous skeleton, (*c*) in relation to adjacent structures, and (*d*) in relation to its component segments.

I. *Holotopy.* (Relation to the general body.)—1. The ureters lie bilaterally extraperitoneal on the dorsal lumbar and lateral pelvic wall. 2. They lie half in the abdominal, half in the pelvic cavities. 3. They are the most securely protected ducts in the body. 4. The pars renalis is extensively mobile; the pars lumbalis is quite mobile as well as the pars iliaca; the pars parietalis pelvina is quite fixed, while the pars vesicalis is extensively mobile. 5. The left ureter is nearer the median line than the right. 6. Practically the ureter extends from the twelfth rib to the pelvic floor.

II. *Skeletopy.* (Relation to osseous skeleton.)—1. They lie (*a*) bilaterally ventral to the II, III, IV, and V lumbar transverse processes; (*b*) on the sacro-iliac joint, and (*c*)

along the lesser lateral pelvic wall. 2. The middle of the ureter corresponds to the mid-point of a line drawn from the processus xiphoideus to the crest of the symphysis pubis. 3. The course of the ureter corresponds practically to a line extending perpendicularly from the junctions of the inner and middle thirds of the ligamentum inguinale (Poupart's) to the twelfth rib. The left ureter lies slightly nearer the vertebral column than the right. 4. The flexura iliaca ureteris, *i.e.*, where the ureter crosses the vasa iliaca, is a short distance proximal to the horizontal plane of the anterior superior spines of the ilium. 5. The middle arterio-ureteral crossing, *i.e.*, the point where the ureter crosses the vasa iliaca, corresponds to the sacro-iliac joint, is the nearest to the anterior abdominal wall. 6. At the sacral promontorium the ureters are two and one-half to three inches apart. 7. In the lesser pelvis the ureter courses close to the base of the spina ischiadica.

III. *Syntopy.* (Relation to adjacent organs.)—General. The ureter lies in an extensive mobile bed of loose areolar and fascial tissue. 1. It is located immediately dorsal to the peritoneum, surrounded by a fibrous areolar sheath, and is attached to the peritoneum by a certain number of fibrous strands which rupture on separating the ureter and peritoneum. In spare subjects one can observe the ureter resembling a white band shimmering through the dorsal peritoneum. The ureter lies immediately dorsal to the peritoneum, being loosely attached to it.

A. (Ventral.) 2. *The blood-vessels* ventral to the ureter are: (*a*) The vasa ovarica which cross the ureter at the proximal arterio-ureteral crossing of the utero-ovarian artery (lumbar region). (*b*) The vasa uterina which cross the ureter at the distal arterio-ureteral crossing of the utero-ovarian artery. This is the most important landmark in the pelvis. It is the grand pelvic crossing. It is a fixum punctum. (*c*) (Right.) The vasa ileo colica and vasa colica media dextra (mesenterica superior). (*d*) (Left.) Vasa colica sinistra (mesenterica inferior). In the pars lumbalis ureteris all vessels pass ventral to the ureter and immediately under the peritoneum; hence the

ureter can be surgically attacked retroperitoneally without damage to visceral vessels. Surgical attacks on the pars pelvina ureteris are dangerous as regards vessels. The nervosa plexus ovarica passes ventral to lumbar ureter. The *organs* ventral to the ureter (right) are: (*a*) peritoneum duodenum; (*b*) distal end of ileum (with perhaps cæcum and appendix); (*c*) ovarium; (*d*) oviduct; (*e*) ligamentum latum; (*f*) urinary bladder. (Left.) (*a*) Sigmoid (the ureter lies in the fossa intersigmoidea); (*b*) ovarium; (*c*) oviduct; (*d*) ligamentum latum; (*e*) urinary bladder; (*f*) enteronic loops lie ventral to both right and left abdominal ureter.

B. (Dorsal.) 1. The ureter lies extensively on a *muscular* bed. (*a*) The most extensive muscular support of the ureter is furnished by the psoas muscle (major and minor), on which it loosely lies from its origin to the vasa iliaca; (*b*) the ureter is less intimately related to pyriformis; (*c*) obturator internus; and (*d*) levator ani. The pelvic muscles are divided from the ureter by the branches of the internal iliac with their tunic fibrosa vascularis and the plexus nervosus sacralis. The muscularis rotundum uteri has distant relations with the ureter.

2. *Blood-vessels* dorsal to the ureter are: (*a*) The vasa iliaca which project the ureter into an angle, the flexura iliaca ureteris; (*b*) branches of the internal iliac; (*c*) the ureter courses through a vast mesh-work of pelvic veins (plexus pampiniformis). 3. *The nerves* dorsal to the ureter are: (*a*) Lumbar lateral chain; (*b*) lumbar plexus, both embedded in the psoas muscle; (*c*) the nervus genito femoralis lies dorsally almost in contact with the ureter; (*d*) the hypogastric plexus; (*e*) plexus nervosus sacralis.

C. (Lateral.) 1. *The viscera* external to the ureter are: (*a*) The distal pole of the kidney. The portio adrenalis ureteris lies close and fixed to the kidney, mainly lying in a groove in the renal substance. It is enclosed in the adiposus renalis; (*b*) the right colon lies at some distance external to the ureter; (*c*) the appendix and cæcum are mainly externally lateral to the ureter. The left colon is further removed laterally from the ureter than the right colon. 2. The *muscles* lying laterally

to the ureter are: (*a*) Psoas; (*b*) pyriformis; (*c*) obturator internus, and (*d*) levator ani.

3. *Blood-vessels* lying laterally are: (*a*) The middle of the vasa ovarica, lying parallel to the ureter; (*b*) the vasa iliac externis; (*c*) branches of the vasa iliac internus. 4. *The nerves* lying lateral are: (*a*) the middle segment of the plexus ovarica; (*b*) plexus lumbalis; (*c*) plexus sacralis.

D. (Medial.) 1. The blood-vessels lying medialward from the ureter (right) are (*a*) a segment of the vasa ovarica; (*b*) the vena cava to which the ureter lies close, frequently in contact; (*c*) the uterine segment of the utero-ovarian artery lies close to the pelvic segment of the ureter.

(Left.) The left ureter lies nearer the aorta than the right. The ureter at the important medial arterio-ureteral crossing, *ie.*, at the point where the ureter crosses the vasa iliaca, reverses its intimate medial relations to large vessels, and assumes externally lateral relations to the large vessels. 2. Medially the ureter is related to *nerves,* (*a*) the lateral lumbar chain; (*b*) the hypogastric plexus; (*c*) the cervico-uterine ganglion (pelvic brain). 3. The medial *visceral* relations of the ureter are (*a*) the rectum, which the ureter quickly approaches on entering the lesser pelvis.

At the pelvic floor the ureter and rectum approach still closer, whence the rectum becomes directed dorsally and the ureter ventrally. High rectal operations involve the ureters. Distended rectum closely approaches the ureters. (*b*) The ureter approaches the lateral surfaces of the bladder from its fundus or dorsal wall. It passes to the bladder through the large plexus venosus vesicalis, whence it penetrates the bladder-wall obliquely for about three-quarters of an inch to end as a mucous slit, the distal orificium ureteris. In penetrating the vesical wall obliquely it forms a valve which prevents regurgitation of urine. The ureter does not blend with the vesical muscularis, but passes through the bladder-wall independently, accompanied by its tunica fibrosa. (*c*) The ureter courses about one-half inch from the lateral border of the cervix immediately dorsal to the arteria uterina. (*d*) The ureter passes through the vast plexus venosus vaginalis to the lateral and

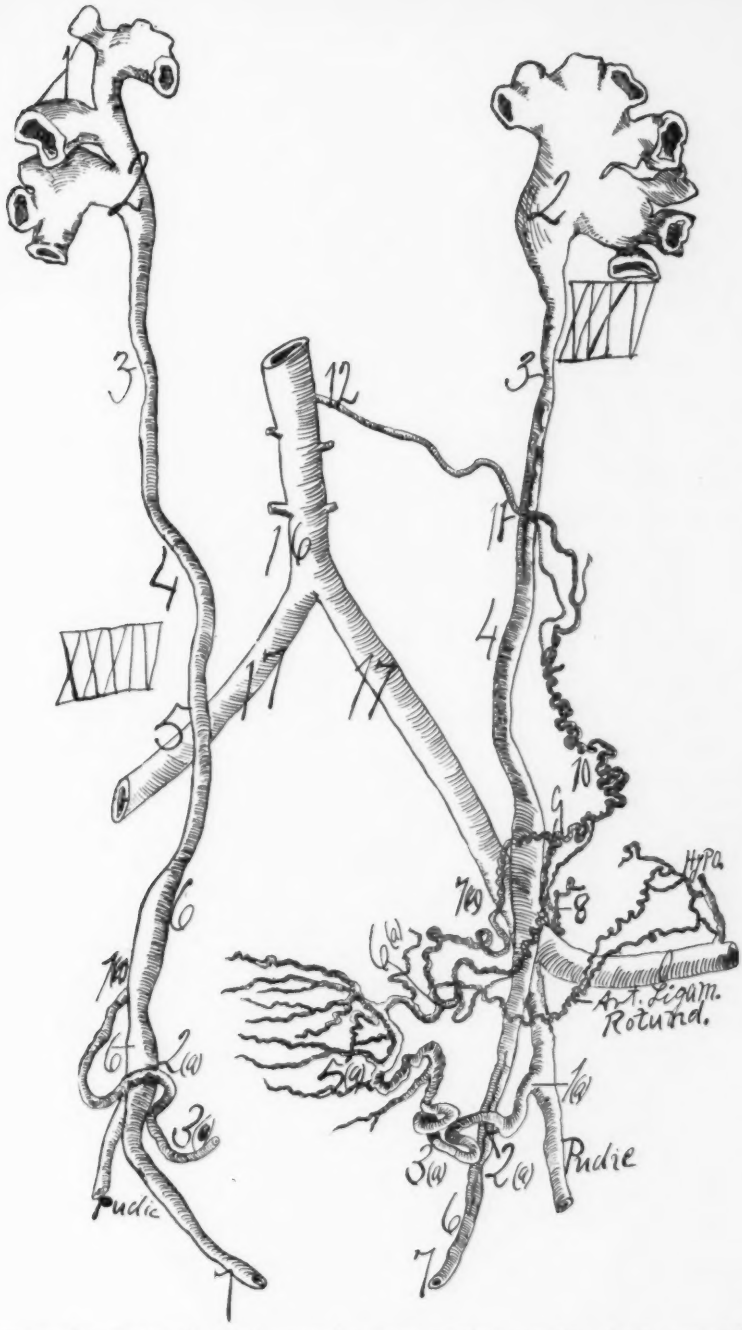

FIG. 9 presents the ureters in relation to the utero-ovarian vascular circle, especially in No. XXXV. The spiral segment of the utero-ovarian vascular circle—circle of author—(1 (a), 2 (a), 3 (a), 4 (a), 5 (a), 6 (a), 7 (a), 8, 9, 10, 11, 12) is a tripedal arch with one foot arising from the aorta (12); another foot springs from the internal iliac at 1 (a), and a third foot is emitted from the external iliac (hypo). The spiral segment crosses ventral to the ureter three times, but presents practical relations with the ureter only at the proximal (11) and distal (1 (a)) arterio-ureteral crossings. The most important of all arterio-ureteral relations is the distal arterio-ureteral crossing at 2 (a), and also the ureteral relations to the cervical loop (2 (a), 3 (a), 4 (a)).

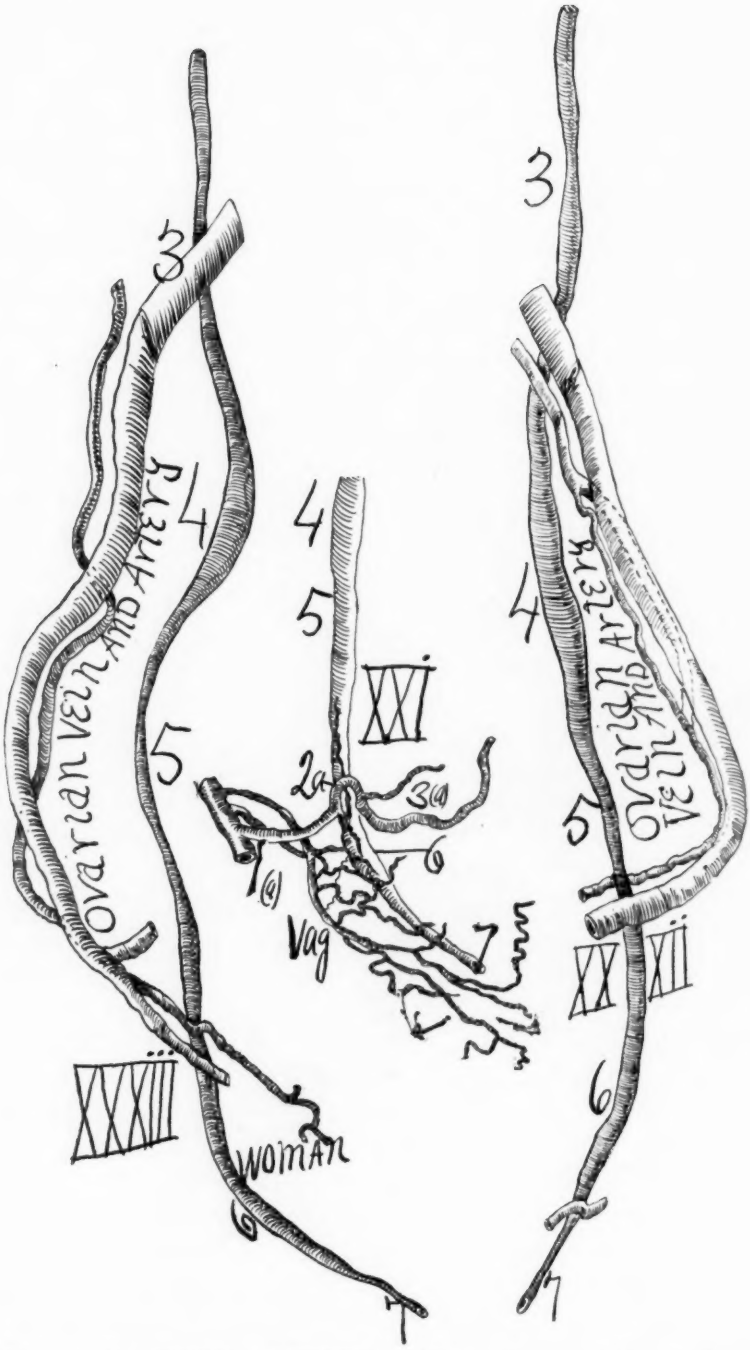

FIG. 10.—Nos. XXXII and XXXIII, middle-aged woman with prominent ureteral spindles. XXXIII has three pelvic ureteral spindles. XXI, distal end of female ureter with relations to arteria uterina (1 (a), 2 (a), 3 (a)) and arteriæ vaginales (Vag.), two spindles (4) and (6) pronounced.

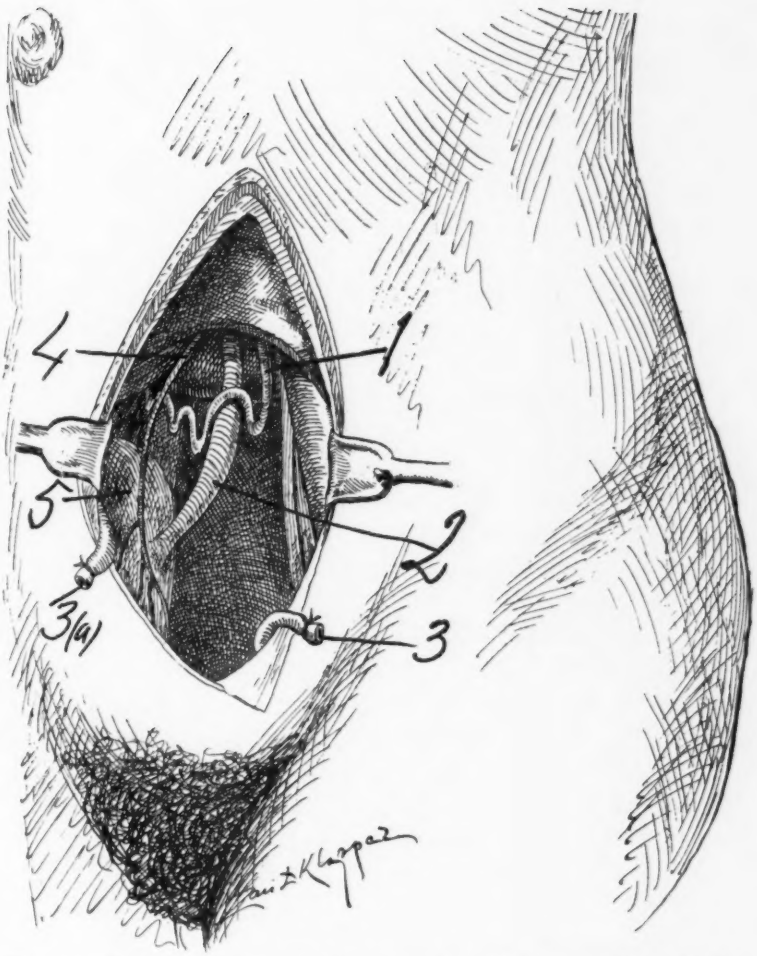

FIG. 11.—Ureter in erect attitude exposed. 1. Arteria uterina with its arterio-ureteral crossing on the ureter and the cervical loop between the uterus and ureter. 2. Pelvic ureteral spindles. 3 and 3 (a). Arteria hypogastrica. 4. Arteria vesicals superior. 5. Vesica urinaria. In this drawing a suggestion from Drs. Tandler and Halban is employed.

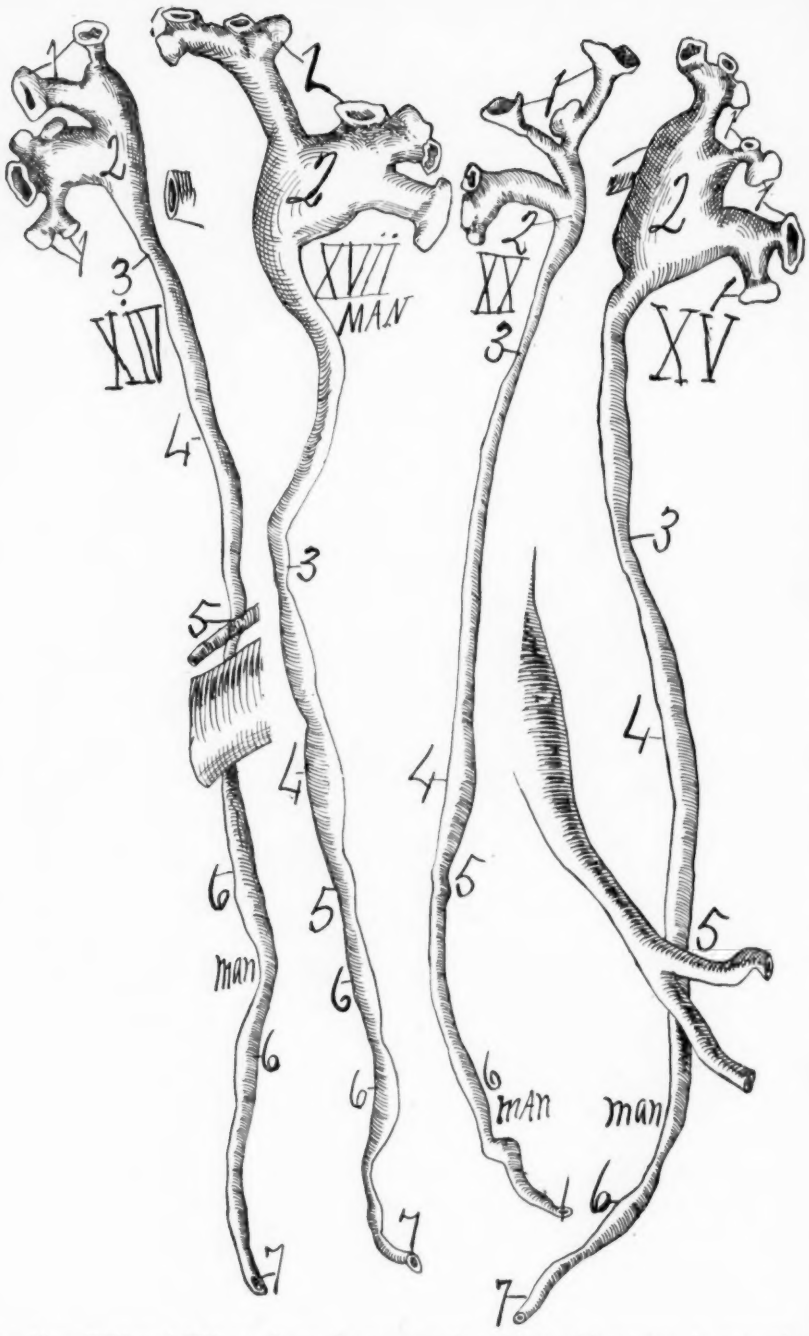

FIG. 12.—Nos. XIV and XV are from the same male subject with ureters in natural course. The common iliacs at 5 (No. XV) did not fill with injected mass, hence small. At 5 (No. XIV) the common iliac filled, hence natural size.

(P.S.—The ureters XIV and XV, by mistake, were drawn dorsal to the arteriæ iliaca.)

Observe the pronounced spindles in No. XVII; both the lumbar (4) and pelvic spindles (6, 6) appear double. Note variations in calices and pelvis.

ventral vaginal fornices, where it assumes important relations with the vagina, especially in pelvic surgery; the trigonum vesicæ rests on the ventral vaginal wall.

IV. *Idiotopy.* (Relation of component ureteral segments.)—The important factors in the relations of the different component segments of the ureter to each other are the narrow isthmuses, the wide reservoirs, the calices, and the ureteral flexures. Ureteral isthmuses obstruct calculi, while spacious ureteral reservoirs entertain them. Ureteral flexures may obstruct both urine and calculi.

Development.—The ureter arises from an invagination of the mesonephrotic duct located at the end of the Wolffian body. It is the duct of the matanephros.

Number.—Two, bilaterally symmetrical.

Form.—1. It is irregularly cylindrical in the living, depending on quiescence or function. In cadaver it is flattened from pressure chiefly dorsoventral. 2. It is an irregular calibered tube. 3. It has usually three dilatations (ureteral reservoirs). 4. Its calices are irregular in number, size, and distribution. 5. Its reservoirs, ureteral pelvis, lumbar and pelvic spindle are irregular in size and location, and the spindles vary in number. 6. Its isthmuses or sphincters are irregular in location and caliber and number.

7. Curvatura ureteris.
   1. Medial lumbar.
   2. Lateral pelvic.
   3. Ventral lumbar.
   4. Dorsal pelvic.
   5. The curves of the ureter resembling the letter S imitate the body wall.

8. Planum ureteris.
   1. Dorsoventral.
      (Lumbosacral curves due to osseous skeleton.)
   2. Transverse.
      (Lumbopelvic curves due to distal kidney pole and expansion of lateral pelvic wall.)

9. The rule of late developed organs, as the ureter, is to be subject to frequent anomalies of form and irregular caliber.

Borders and Surfaces are exposed in detail in discussion on ureteral position and ureteral relations to adjacent individual structures.

Sphincters.—There are three important sphincters or isthmuses: 1. A proximal isthmus or sphincter located at the so-called neck of the ureter. This bend or kink is due to the medial projection of the distal kidney pole. This ureteral curve I shall term the flexura renis ureteris.

2. There is a middle ureteral sphincter or isthmus located at the middle arterio-ureteral crossing, *i.e.*, where the ureter crosses the vasa iliaca. This ureteral constriction is due to the ventral projection of the ureter by the iliac vessels. This bend or kink in the ureter I shall term the flexura iliaca ureteris. It is the most accessible to palpation.

3. There is the distal ureteral sphincter or isthmus located at the point where the ureter penetrates the bladder-wall. This sphincter is due to the gradual narrowing of the ureteral caliber as it passes obliquely through the muscularis and mucosa of the parietes vesica urinaria.

The diameters of the three ureteral sphincters or isthmuses in order of dimensions are: 1. The distal, one-tenth of an inch; 2. Proximal, one-seventh of an inch, and 3. The middle, one-fourth of an inch.

Flexures.—There are three important flexures. 1. The flexura renis ureteris, located at the ureteral neck and due to the medialward projection of the distal kidney pole. 2. Flexura iliaca ureteris, *i.e.*, where the ureter is flexed as it crosses the vasa iliaca. 3. Flexura pelvina ureteris, *i.e.*, where the ureter lies curved on the bladder and pelvis wall.

Proximal Extremity.—The proximal extremity consists of the ureteral calices and ureteral pelvis located in the renal sinus or renal pocket.

1. It begins at the renal pyramids which project, or invaginate, into the ureteral calices like a finger in a glove. 2. As a rule, each renal pyramid opens sieve-like into a ureteral calyx.

3. The proximal end of the ureter presents from four to eighteen, usually, however, about eight calices. 4. The junction between ureteral calyx and renal substance, pyramid, is at the sieve-like perforated apex of the renal pyramid. 5. The blunt rim of the ureteral calyx surrounds the base of the renal pyramid. 6. A major ureteral calyx is a varying cylindrical structure of about one inch in length and one-third of an inch in diameter, which opens distalward at its apex by sieve-like openings. 7. The ureteral calices, the beginning of the ureter, are attached to the floor of the renal pocket by means of renal pyramids perforated at their apices. 8. The ureteral calices consist of a proximal set which converge into a main proximal arm and a distal set which unite into a main distal arm; finally, the main proximal and distal arms of the calices open into the ureteral pelvis. 9. Practically, each kidney consists of a collection of varying sized kidneys—the renal pyramids—which pour their urine into separate calices, and the calices pour their contents into a common reservoir,—the ureteral pelvis. 10. The calyx presents the shortest distance and most direct route from the renal pyramid to the ureteral pelvis. 11. The calices, like the tributary arms of a great river, collect the urine from the various renal regions drained by the pyramids and converging streams into the great urinal reservoir—the ureteral pelvis, which, with the calices, will frequently hold an ounce. 12. The proximal ureteral extremity rests in a rich bed of areolar fascial tissue which may become so extensive that it appears pathologic. The connective tissue compactly surrounds the proximal extremity of the ureter so strongly that it makes a difficult dissection to free it for inspection. 13. The proximal calicular arm is the chief one as regards direction, but is the smaller. 14. The distal calicular arm is the larger, and contains perhaps one or two more calices, but appears more like lateral tributaries to the ureteral pelvis. 15. The caliber of the ureteral pelvis, irregularly oval, is about four times that of the calices.

The ureteral pelvis (right) lies dorsal to the junction of the duodenum descendens and duodenum transvenum, while

the left ureteral pelvis lies close to the junction of the colon transversum and sinistra; both these relations of position are variable.

Distal Extremity. — 1. It penetrates the bladder-wall obliquely for about three-fourths of an inch.

2. It forms within the bladder-walls a perfect non-regurgitating valve.

3. It opens significantly in the vesical mucosa as a depressed oblique, oval, mucous slit one-eighth of an inch in length. Urine may enter a distended bladder, but it cannot escape by regurgitation, on account of the oblique valve in the vesical wall.

4. The ureteral orifices form two of the angles of the trigonum vesicæ (Lieuataudii), and are located with the chief sensory nerves in the foldless mucosa of the trigone.

5. The distal end of the ureter penetrates the tunica fibrosa and tunica muscularis of the bladder independently surrounded by (a ureteral sheath) musculo-fibrous tunic. The ureteral orifice necessarily blends with the vesical mucosa.

6. The independent penetrations of the bladder-wall by the ureter surrounded by its own ureteral sheath or musculo-fibrous tunic insures independent bladder and ureteral function.

7. The distal ureteral orifices stand about one inch apart in the resting bladder, but in the well-distended bladder they may be separated two inches.

8. At the proximal external angle of the mucous oval slit of the distal ureteral orifice there is a thin mucal fold which facilitates ureteral catheterization. Immediately after the ureter enters the pelvis, it becomes richly supplied by a large number of veins, and the nearer it approaches the tractus genitalis the more it resembles it in being supplied by a large number of large veins. The distal end is the most mobile of the ureteral segments; however, it moves with the trigonum vesicæ and the enclosed musculo-fibrous ureteral sheath. Perhaps the space between the ureter and ureteral sheath is a space which facilitates the wide range of mobility of the distal ureter.

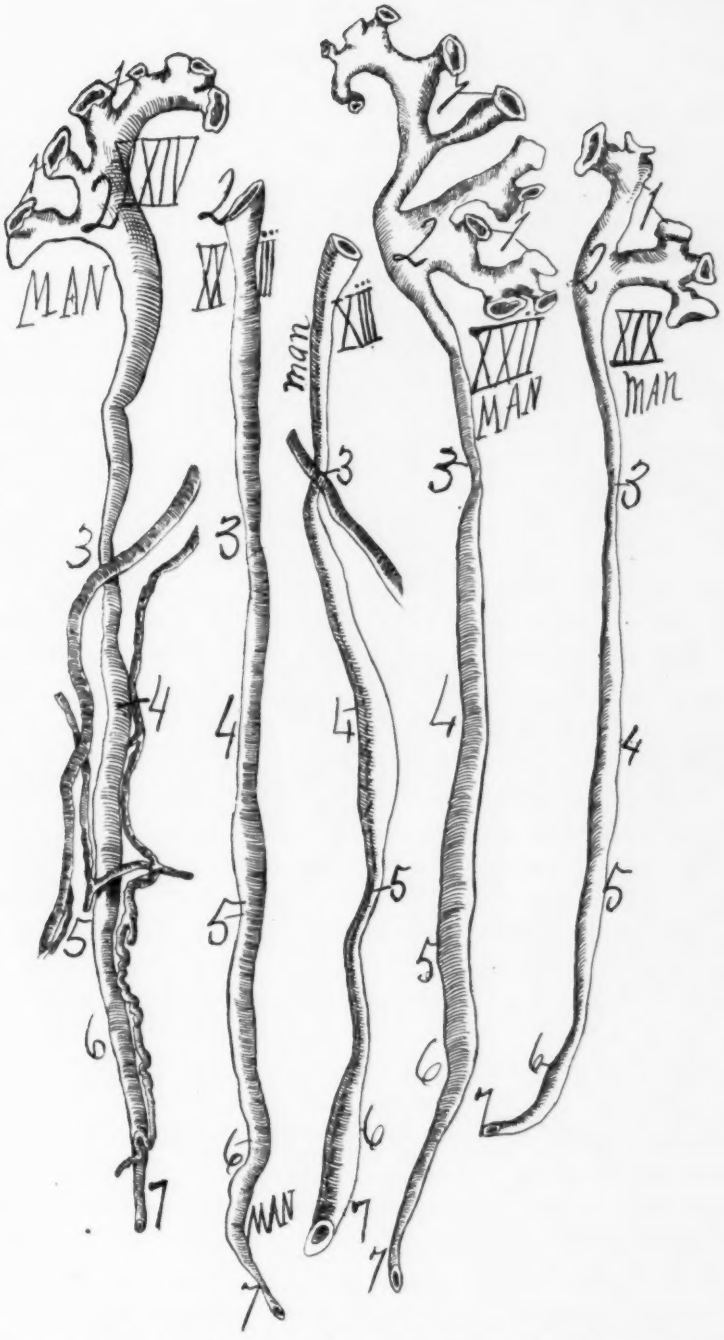

FIG. 13 presents a wide range of ureteral calices, pelves, isthmuses, and spindles. The calices vary more than any other ureteral segment. The calices consist practically of a major, proximal arm, and a major, distal arm. No. XXIV is accompanied by the injected spermatic vessels.

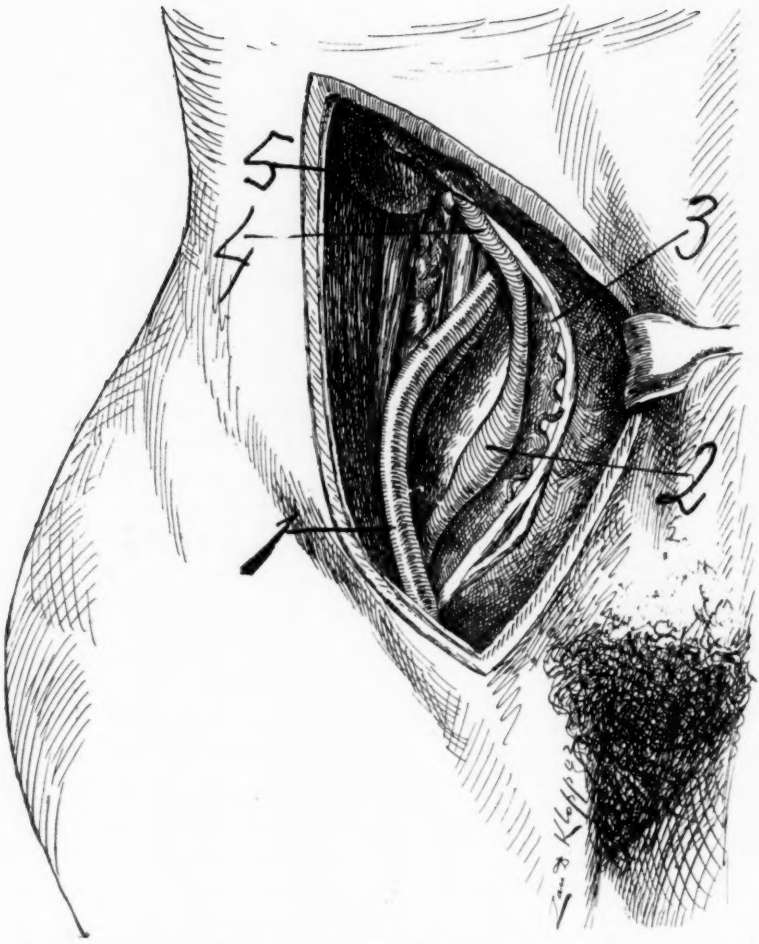

FIG. 14 presents the lumbar ureteral spindle exposed in the lateral abdominal region while in the erect attitude. 1. Arteria iliaca communis. 2. Lumbar ureteral spindle. 3. Vasa spermatica. 4. Pars infrarenalis ureteris. 5. Kidney. In this cut a suggestion from Drs. Tandler and Halban is used.

The Relation of the Ureter to Other Viscera and Adjacent Structures.—Relation of the ureter to vessels is of practical importance. The most important uretero-vesicular relation is (*a*) the distal arterio-ureteral crossing of the pelvic-floor segment of the utero-ovarian artery. This is the most important landmark in the pelvis. It is generally located about the midpoint of the pelvic-floor segment. It is also located about midway between the lateral cervical border and lateral pelvic wall. The distal arterio-ureteral crossing is the point where the ureter crosses dorsally at acute angle the arteria uterina. It is the grand pelvic crossing (Lucy Waite). It is the pelvic arterio-ureteral fixum punctum where the T-shaped distal arteria ureterica is emitted which passes both proximal and distalward on the ureter.

(*b*) The middle arterio-ureteral crossing is where the ureter crosses the vasa iliaca ventrally, also where the middle arterio ureterica passes from the arteria iliaca to the ureter. This is a practical point, as the ureter here approches the closest to the ventral abdominal wall, and may be palpable.

(*c*) The proximal arterio-ureteral crossing is where the ureter passes dorsal to the ovarian segment of the utero-ovarian artery, and where the T-shaped arteria ureterica is emitted, passing proximal and distalward on the ureter. The proximal uretero-ureteral crossings, usually not on the same level, are located at the apex of the uretero-venous triangles of the author. The arteries ileocolic, colica dextra, and those of the inferior mesenteric artery (sinistra) pass ventral to the ureter.

As to veins, the right ureter lies close to the distal vena cava, while the pelvic ureters pass through vast plexuses of large veins. The relation of the ureter to great venous plexuses may be observed in its course through (*a*) the plexus venosus uretero-vaginalis, and (*b*) the plexus venosus vesico-vaginalis. The extra musculo-fibrous tunic ureteral sheath of the distal end is microscopically rich in vessels, and firmly bound to the distal arterio-ureteral crossing as well as some of the arteriæ

vaginales which supply its distal ureteral end. The left ureter lies close to the abdominal aorta.

The relation of ureter to the vagina is of extreme practical importance in gynæcology and obstetrics. Immediately after the ureter has passed the cervix uteri it lies embedded in a loose mass of cervico-vesical connective tissue between vagina and fundus of the bladder. The ureter lies practically in contact with the lateral and ventral vaginal fornices for about one-half of an inch. The ureter in its vaginal relations is well sheathed by the extra tunica musculo-fibrosa ureteral sheath. From a point about two-thirds of an inch distant from each lateral border of the cervix uteri the ureters converge medially. If one looks dorsalward into a well-dissected pelvis, the two medially converging ureters appear to embrace the proximal end of the vagina like two lateral arms. The ureter and vaginal wall are in contact at about the level of the ventral cervical lip, the most distal point of the cervix. Since the ureter is in fixed contact with the ventral vaginal wall through strong connective tissue, it moves with the proximal vagina; hence, in performing vaginal hysterectomy the cervix should be drawn well distalward, and the ventral vaginal wall forced well proximalward by instruments during separation of bladder from uterus, to avoid injuring the ureters. The distal ureteral orifices correspond to a point at the level of the middle of the vagina. The ureteral orifices lie about one and one-half inches distal to the os uteri externum.

The extra fibro-muscular ureteral sheath extending several inches at the distal end of the ureter guards the ureter from injury. It is by means of the fibro-muscular ureteral sheath that it is so intimately connected with blood-vessels, vagina, and bladder.

Relation of the Ureter to the Bladder.—The relation of the ureter to the bladder should be considered in two segments, viz., (*a*) extramuralis and (*b*) intramuralis. Both extra- and intra-vesical segments are of extreme importance in obstetrics and gynæcology, especially in the large field of vaginal hysterectomy. The extra-mural segment is the one which is the

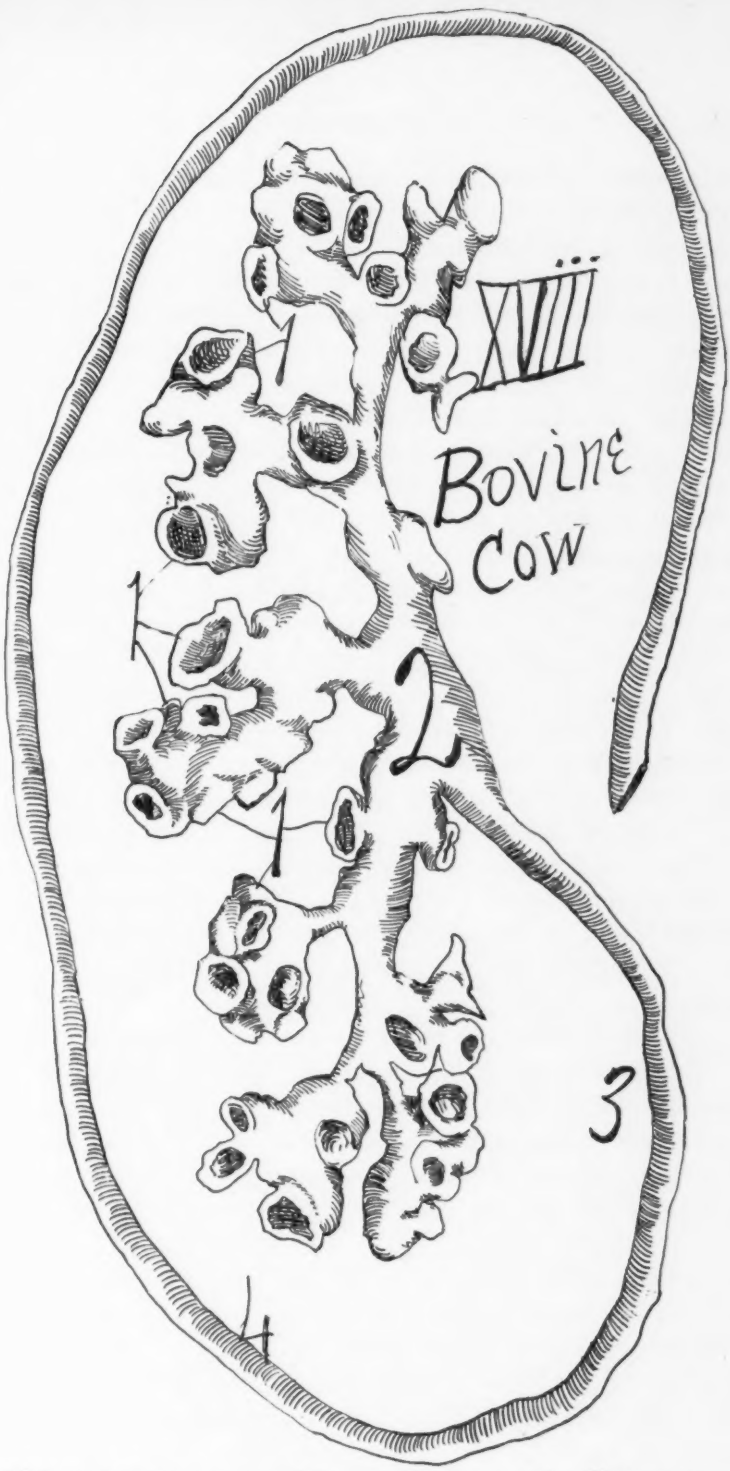

FIG. 15.—Adult cow's ureter. 1. 1. 1. Calices. 2. Pelvis. 3. and 4. Ureter proper. Animals possessing lobulated kidneys possess numerous branched calicular arms with insignificant ureteral pelvis. Animals with smooth kidneys possess a ureteral pelvis. This ureter (quadruped) has spindles. It is not a uniform calibered duct. The irregular appearances are due to the injection to a slight extent.

more liable to trauma on account of its intimate relation to the cervical loop or the internal position of the pelvic-floor segment of the utero-ovarian artery. The extra-mural portion is also the segment of the ureter which is so intimately related to the vagina. The extra-mural segment possesses a strong ureteral sheath which accompanies the ureter through the bladder-wall. It bends medialward before it ends in the bladder. The pars intramuralis is the half inch of the fixed distal end of the ureter. It lies within the vesical wall. The ureteral sheath lessens as the ureter passes with it obliquely through the bladder-wall. The distal ends of the two ureters and the proximal end of the urethra together form the trigonum vesicæ and isosceles triangle of foldless mucosa containing the chief vesical sensory nerves. A ureteral fistula in either the intra-mural or extra-mural segments is difficult to heal. I have observed one in practice that lasted three years in spite of numerous operations. The extra-mural segments in the resting bladder are separated about one and one-half inches, but in a well-filled bladder may be separated over two inches.

Relation to the Cervix.—The relation of the ureter to the cervix uteri is important in gynæcology and obstetrics, especially in hysterectomy per vaginam. The ureter passes by the lateral border of the cervix uteri about two-thirds of an inch distant from its supravaginal portion. Its course is acutely oblique as regards its cervix uteri.

From the distal arterio-ureteral crossing the ureter rapidly approaches the border of the cervix uteri. The ureter lies between the cervicovaginal venous plexuses. As it courses by the cervix, it lies in a vast bed of loose areolar tissue, and is hence mobile and shiftable, changing its distance from the cervix uteri. One can force the ureter not only the length of the cervical loop, which may be one and one-half inches from the cervical border, but over half an inch additional. This allows two inches of cervical loop to ligate in hysterectomy, which is utilized through drawing the cervix distalward by traction forceps. Through the distal arterio-ureteral crossing, the grand crossing of the pelvis, is a fixum punctum due to

the distal arteria ureterica being emitted at this point by the strong connective tissue, yet this fixum punctum can be shifted, forced laterally, which is the all-important point in gynæcological surgery, gaining space in order that ureteral trauma may be avoided. Practically, the ureters embrace the cervix uteri

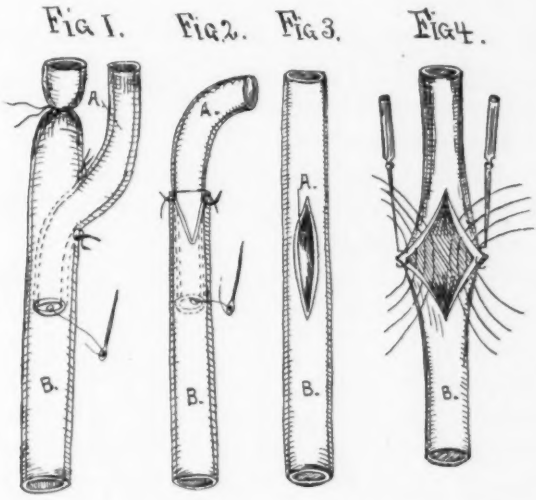

FIG. 16 illustrates methods of ureteral repair. A. Proximal and (B) distal segment of ureter. Fig. 1. A is drawn into the lumen of B through a slit in the lateral ureteral wall and sutured *in situ.* B is ligated at its proximal end. Fig. 2. A is drawn into the lumen of B through the proximal end of B, which is facilitated by splitting the proximal of B. It is sutured *in situ.* Fig. 3 may present a stricture of the ureter, to relieve which an incision is made longitudinal to the ureter; subsequently the ureteral incision is sutured transversely as is indicated in Fig. 4. Dr. Van Hook's method is included in this cut. It is very evident that ureteral surgery is facilitated by performing the operation in the region of the spindles or reservoirs, where ample lumen and wall present for manipulation and suture.

at the level of its internal os, viz., about one and one-half inches previous to penetrating the vesical wall. At the level of the internal os the ureters are separated about two and one-half inches; however, by traction forceps on the cervix this distance can be materially changed. Successful avoidance of

ureteral trauma consists in two factors, viz., drawing the cervix distalward with traction forceps and forcing the ureters lateralward and proximalward with specula.

Relation of Ureter to Rectum is important in Practice.—1. The ureter varies in its relation to the rectum according to the resting (contracted) or distended (functionating) state of the rectum.

2. The ureter assumes intimate relations with the rectum immediately on entering the lesser pelvis.

3. The ureter and rectum assume the same sagittal sacral curve with concavity ventrally.

4. The left ureter is about one inch distant from the rectum in the proximal part of the lesser pelvis, while the right ureter is about one and one-half inches.

5. In the distal segment of the lesser pelvis the ureter reapproaches the middle line, while the rectum becomes diverted dorsally.

6. The distended rectum presses against the ureters.

7. The most important point of the relations of the ureter to the rectum is found at (*a*) the level of the spina ischiadica, (*b*) the spina ischiadica corresponds to the ligamentum sacro-uterina, (*c*) the spina ischiadica corresponds to the point where the ureters curve medialward to pass to the bladder, (*d*) the spina ischiadica corresponds to the level of the sphincter vesicæ interna.

At the spina ischiadica the ureter and rectum approach the closest to each other.

8. In extensive operations on the rectum, as the Kraske, the ureters are in danger of trauma. They should be forced with their ureteral sheath from the operative field by traction forceps or specula.

At the pelvic brim the ureters lie against the vertebral column ventral to the transverse processes, and on the ala sacra separated about two and one-half inches, with a segment of the rectum lying between them. Here they approach close to the sigmoid depending on the length of the mesosigmoid, whence they diverge to follow the lateral pelvic wall, gaining a maxi-

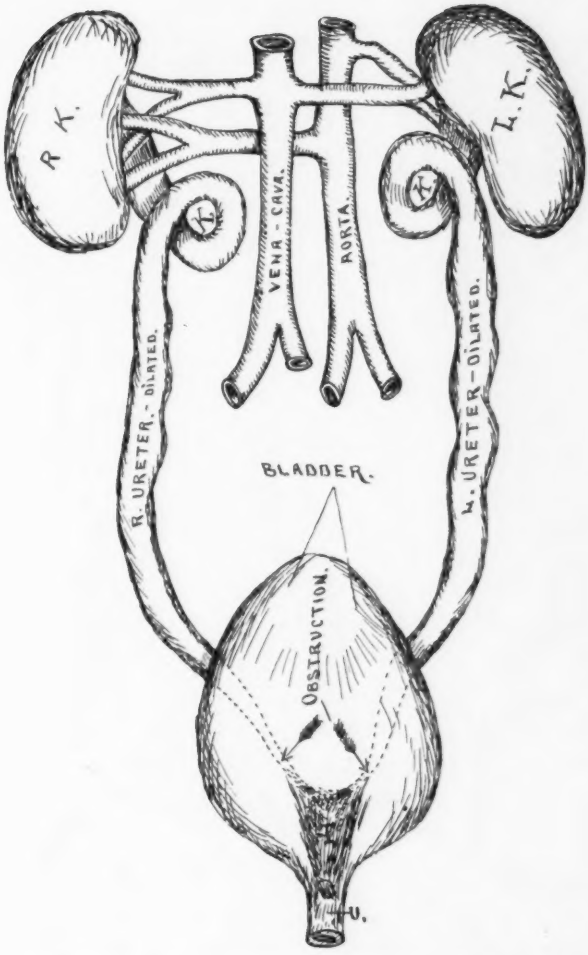

FIG. 17.—Cut demonstrating extensive bilateral ureteral dilatation due to obstruction in the pars intramuralis ureteris. The ureters were extended almost to the size of the enteron. I secured this rare specimen at an autopsy and sketched it *in situ*. Observe the large ureteral spiral at K, K.

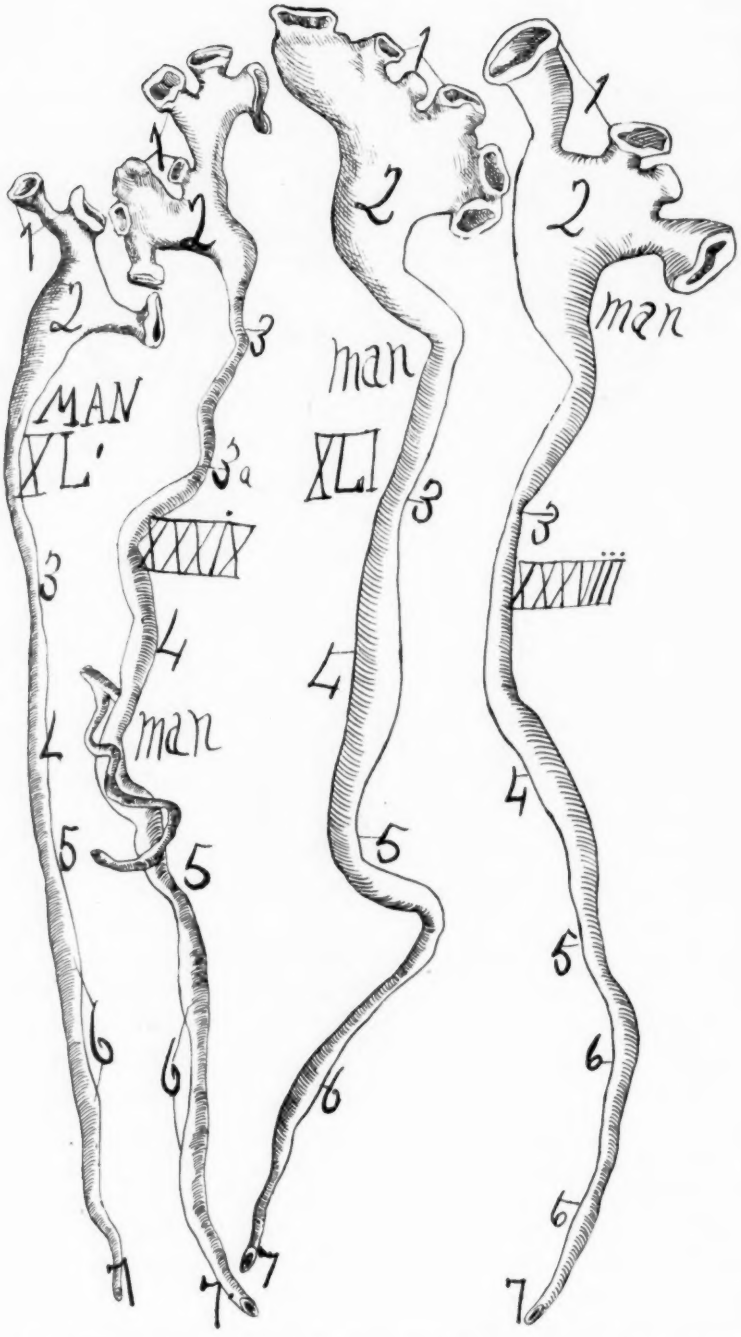

FIG. 18.—4. Ureters of man. The spindles and isthmuses of all are pronounced. Nos. XXXVIII and XXXIX are from the same male subject. Note the variation of the pelvis calices in the same subject. XL and XLI are from different subjects.

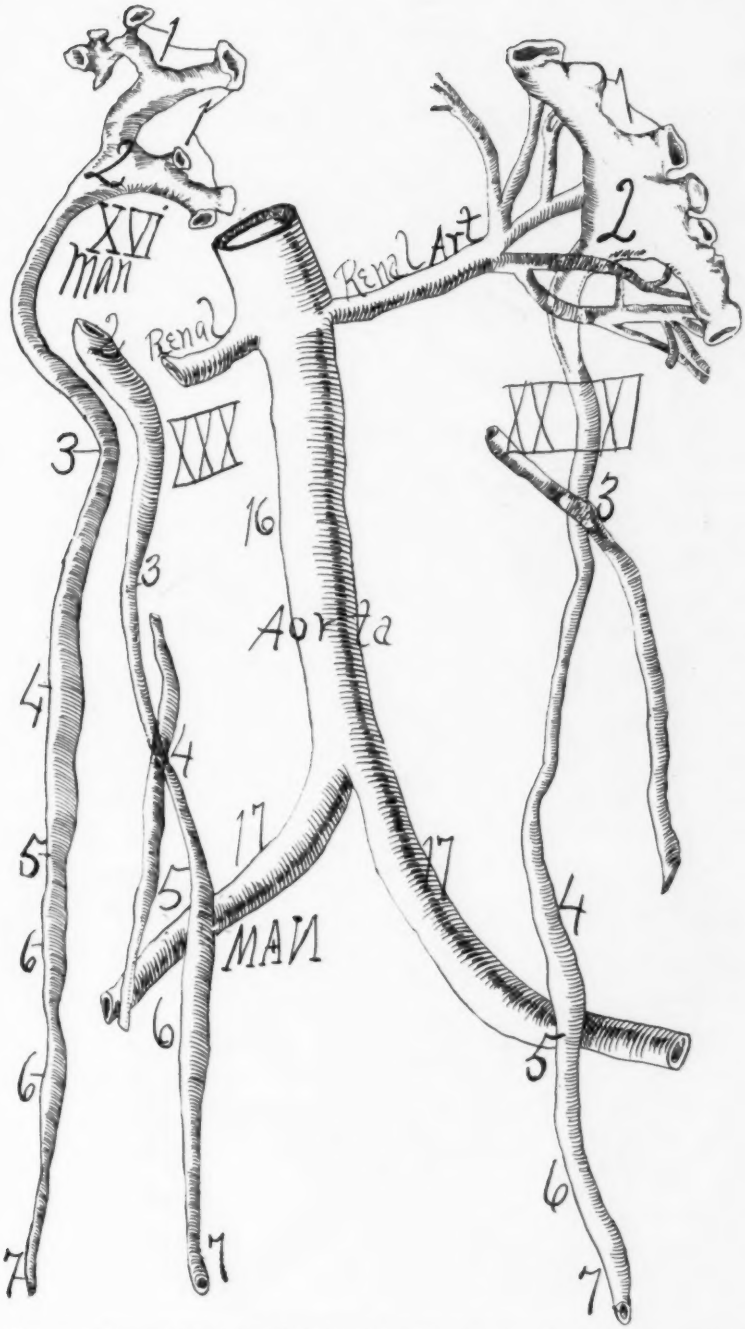

FIG. 19.—Nos. XXX and XXXI are from the same male subject, presenting the proximal and middle arterio-ureteral crossings at 3 and 5. XVI presents pronounced spindles,—two pelvic spindles at 6 and 6. The proximal arterio-ureteral crossing is generally more distally located on the right side, *e.g.*, 4 in No. XXX and 3 in No. XXXI (left side).

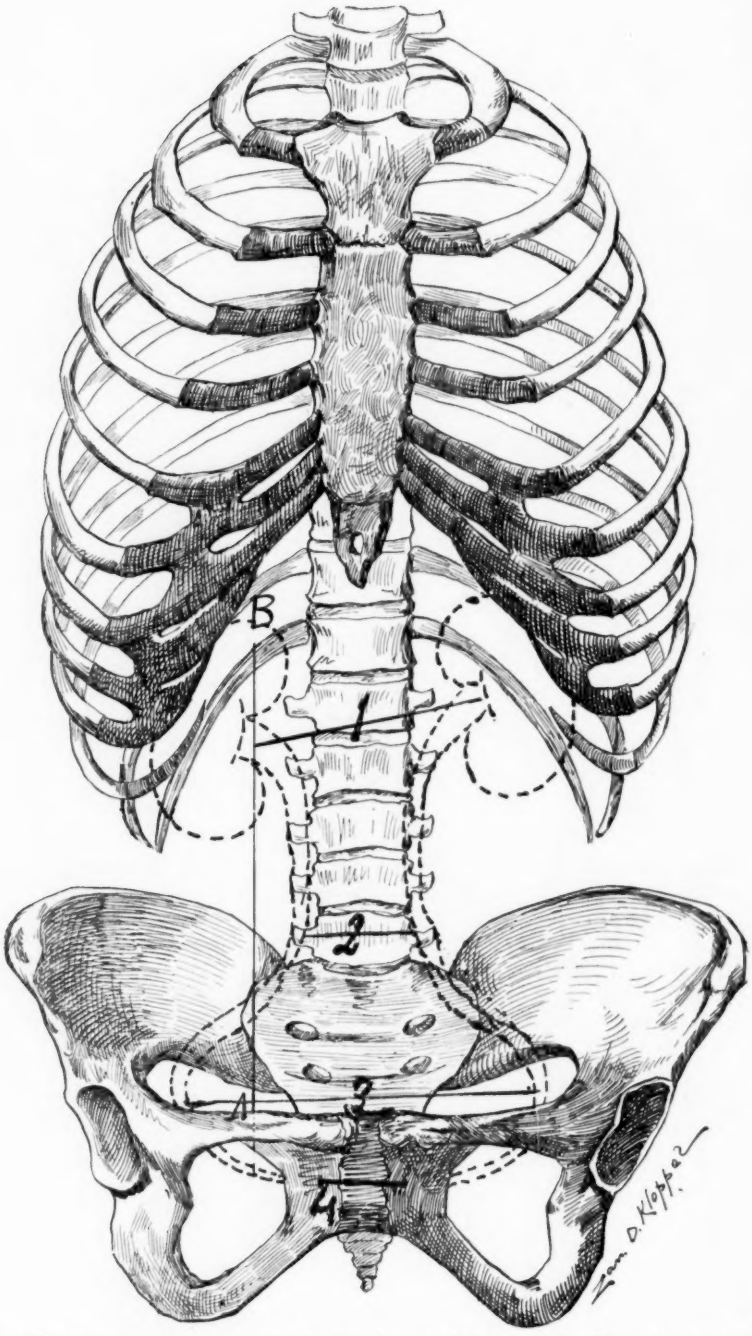

FIG. 20.—The course of the ureters on the dorsal skeletal wall. They lie ventral or in contact to the tip of the II and ventral to the ventral surface of the III, IV, and V transverse processes of the lumbar vertebræ. They curve in the region of the spina ischiadica. 1. Distance between ureteral pelves (four inches). 2. Shortest distance between lumbar ureters (two and one-half inches). 3. Widest distance between pelvic ureters (four and one-half inches). 4. Distance between distal orifices of resting bladder (one inch).

mum separation of about four and one-half inches. The ureters and rectum are not parallel. The ureter follows the lateral pelvic wall, while the rectum follows the sacral curve. However, the ureters converge medialward at the pelvic brim, and at the pelvic outlet the distal ends of the ureter curve ventrally, while that of the rectum curves dorsally, the vagina and pudendum lying between the divergent rectal and ureteral extremities. The ureters approach the lateral and ventral rectal surface similarly with that of the vagina.

The relation of the ureter to the ligamentum latum is significant, because the ureter as it passes through the base of the ligamentum latum practically abandons peritoneal relations and penetrates the abundant pelvic subserosum. Hence the ureter courses through parametrium until it penetrates the bladder. The ureter at its distal end lies in a vast areolar bed, which is necessary for required wide range movements, changing volume and position of the tractus genitalis, tractus intestinalis, and tractus urinarius. The most mobile portion of the pelvic ureter is in the base of the ligamentum latum. The ureter during its course through the base of the ligamentum latum crosses the proximal part of the ligamentum teres uteri; however, the ureters and round ligaments are separated from each other by the plexus venosus vesico-vaginalis. The ureteral sheath is strong, thick, and vascular in the base of the ligamentum latum.

The relation of the ureter to the oviducal pavilion is significant on account of the frequent local peritonitis at the proximal end of the oviduct. The oviducal pavilion, with the ovary in the fossa ovarica, may lie directly on the ureter separated from it by the peritoneum only. Congestion, hyperæmia of the oviduct and ovary periodically (menstruation) or continually (gestation), salpingitis, and ovaritis might affect an adjacent segment of the ureter. Peritoneal infection is liable in 15 to 25 per cent. of subjects to invade the subperitoneal tissue ending in cicatricial contractions which induce constrictions and dilatations in the ureter.

The relation of the ureter to the ovary is important in sur-

gical intervention. If the ovary occupies its usual position in the fossa ovarica, the ureter forms the distal border of the fossa and courses along the margin of the ovary. The free border of the ovary rests on the ureter separated from it by the peritoneum only. If the fossa ovarica is deep on the ureter or large, it may project a fold of peritoneum, a kind of meso-ureterium or the plica ureterica. In the extreme distal position of the ovary the relation of the ureter and ovary may be totally altered, whence the ovary may lie dorsal and distal to the ureter, which would then course along the meso-ovarial border. In the development of ovarian tumors, where the ovary was in the extreme distal position, the ureters may be forced by the tumor proximalward and lateralward. I have seen both ureters severed in a patient where the ovarian tumor forced the ureters proximal to the pelvic bone. The interesting report of the patient was that she recovered; that one ureter only discharged urine through the abdominal wound for six weeks; that after six weeks of complete occlusion of the other ureter by ligature which cut through the ureter, it began suddenly to discharge urine similarly to the other ureter. Hence the kidneys will retire from active service six weeks through ureteral ligation, whence it may resume secretion without apparent injury.

The relation of the ureter to Douglas's fold is not sufficiently intimate to be of much practical importance.

Vital.—Sufficient ureter to conduct urine to the surface mucosa or cutis is requisite for life.

Pathology.—1. The ureter is subject to bacterial disease, —inflammation.

2. The ureter is subject to stricture and dilatation.

3. The defects in the ureter are in peristalsis or obstruction of the urinal stream.

4. The ureter is subject to ureteral calculi.

5. The obstruction of the ureter may be from kink, torsion, stricture, or calculus.

6. Dilatation of the ureter may obtain the dimensions of

the enteron. Tuberculosis of the ureter may make it feel like a hard cord.

Age and Function Relations of the Ureter.—I. In ***pueritas*** (one to twelve years) the ureters are quite spiral in the lumbar segment. The ureters are almost suprapelvic, and hence the flexura iliaca exist to a slight extent only. In pueritas the distal ends of the ureter only partially enter the shallow pelvis; they are located more proximalward and dorsalward than in adults. The lumbar and pelvic spindles are limited in development. The ureteral blood supply from the arteria ureterica distal and proximal is limited from the limited development of the utero-ovarian artery or genital vascular circle. No periodic hyperæmia from genital vascular waves.

II. *Pubertas* (twelve to fifteen years of age). The ureters experience a vast increase of blood from the rapid development of the utero-ovarian artery and consequent increase in quantity of blood which passes through the arteria ureterica distal and proximal. The sudden increase of blood to the proximal and distal arterio-ureteral crossing may have influence in developing the size and capacity of the lumbar and pelvic ureteral spindles, especially as the spindles are more pronounced and sharply defined in woman than in man. The flexura iliaca ureteris rapidly increases from the development of the osseous pelvis and the distalward movements of the internal genitals and bladder. The pelvic ureteral curve, sacral and lateral, increases from the increased development of the os coxæ. The hyperæmia constantly increases towards the ureter through the arteria ureterica proximal and distal during the entire pubertas.

III. *Menstruation* (fifteen to forty-five years). The ureters experience a periodic congestion or hyperæmia at the proximal and distal arterio-ureteral crossings. The utero-ovarian artery rapidly develops as well as the arteria ureterica proximal and distal. The flexura iliaca ureteris increases with the development of the osseous pelvis and distalward movements of the internal genitals and bladder. The pelvic curve, sacral and lateral, of the ureter increases. The pelvic, but especially the lumbar, spindles become more pronounced.

IV. In *gestation* the hyperæmia of the ureter at the distal and proximal arterio-ureteral crossings becomes greatly increased from the mighty development of the utero-ovarian artery. This constant active blood supply must influence the size and capacity of the lumbar and pelvic ureteral spindles.

V. In *puerperium* (three to four months) the rapid decrease of blood from the proximal and distal arterio-ureteral crossings will unfavorably influence the nourishment of the walls of the ureter, especially in the regions of the spindles. At the proximal and distal arterio-ureteral crossings the ureter experiences an involution.

VI. In *climacterium* (forty-five to forty-eight years) the blood supply to the distal and proximal arterio-ureteral crossing is lessened and irregularly periodic.

Arteriosclerosis, calcification, begins with defective nourishment in the regions of the ureteral spindles; a tendency to ureteral dilatation arises. Ureteral parenchymatous cell (muscle, elastic, and epithelium, functionating cells) degeneration now appears, with increase of connective tissue, frame-work cells. The malnutrition results in irregular thickness of the ureteral wall and irregular dilatations.

VII. *In senescence* (forty-eight to termination of life) there is no hyperæmia at the proximal and distal arterio-ureteral crossings. Arteriosclerosis and calcification arise in the proximal and distal arteria ureterica. Pathologic degeneration of ureteral parenchymatous or functionating cells (muscle, epithelium, elastic) and increase of frame-work or connective-tissue cells occur in the regions of the proximal and distal arteria ureterica. Arteriosclerosis and calcification with consequent malnutrition of the ureteral wall results; irregular ureteral dilatation, especially in the regions of the proximal and distal arterio-ureteral crossings, *i.e.*, in the region of the spindles. The irregular ureteral dilatations found in senescence bear out age and functional relation of the ureters in woman. The irregular ureteral dilatations normal or pathologic are more pronounced in woman than in man.

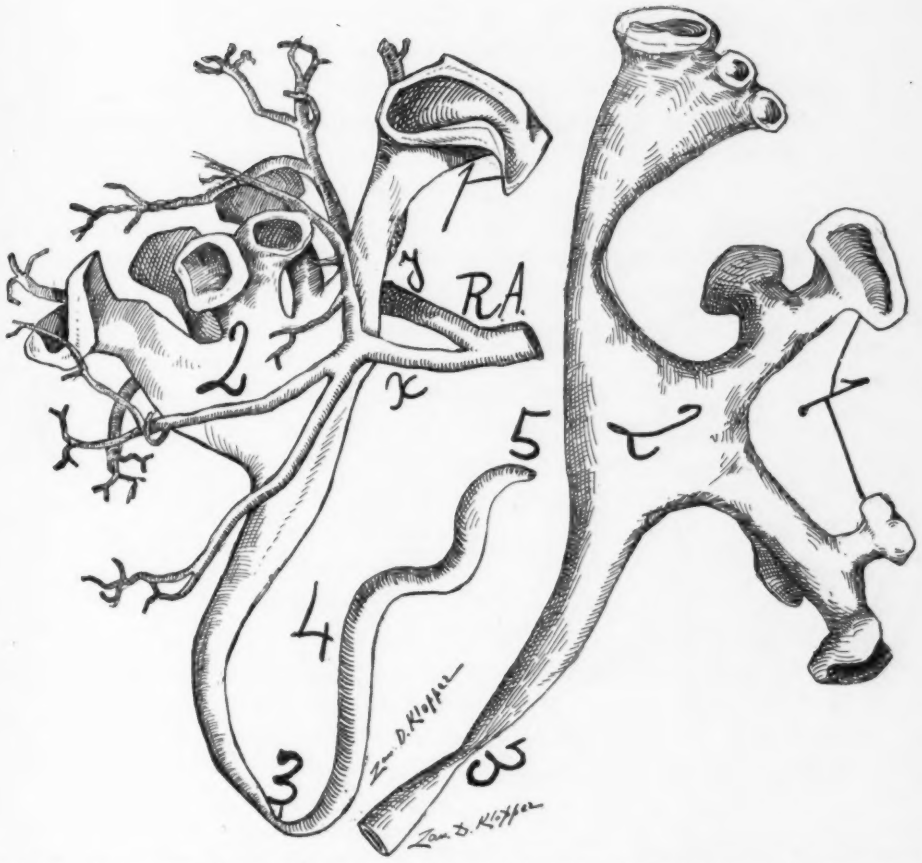

FIG. 21.—A drawing of a paraffin cast of the ureteral calices and pelvis made by the author in 1892. 1. calices; 2, pelvis; 3, proximal ureteral isthmuses (figure to right).

Figure (to left). Drawing of paraffin cast of ureteral calices, pelvis, and renal vessels. I injected melted paraffin into the ureter and renal vessels; placed it in HCl for a week; washed it in slow running water, and my artist, Mr. Zan D. Klopper, drew from it as a model. 1, calices; 2, pelvis; 3, proximal isthmuses; 4, lumbar spindle; 5, middle isthmus. Note spiral ureter. Corrosive anatomy demonstrates, a, the kidney has a double circulation; b, the ventral renal arterial branch (y) is the larger; c, the vascular anastomotic line of the ventral and dorsal segments of the kidney lie dorsal to the external median line of the kidney (this line I shall term Hyrtl's exsanguinated renal zone); d, the line of renal incision for renal calculi should be made dorsal to the external median border when hæmorrhage is simply capillary. I have employed this method in practice with satisfactory results. RA. Arteria renalis. Y. Ventral branch of arteria renalis. X. Dorsal branch.

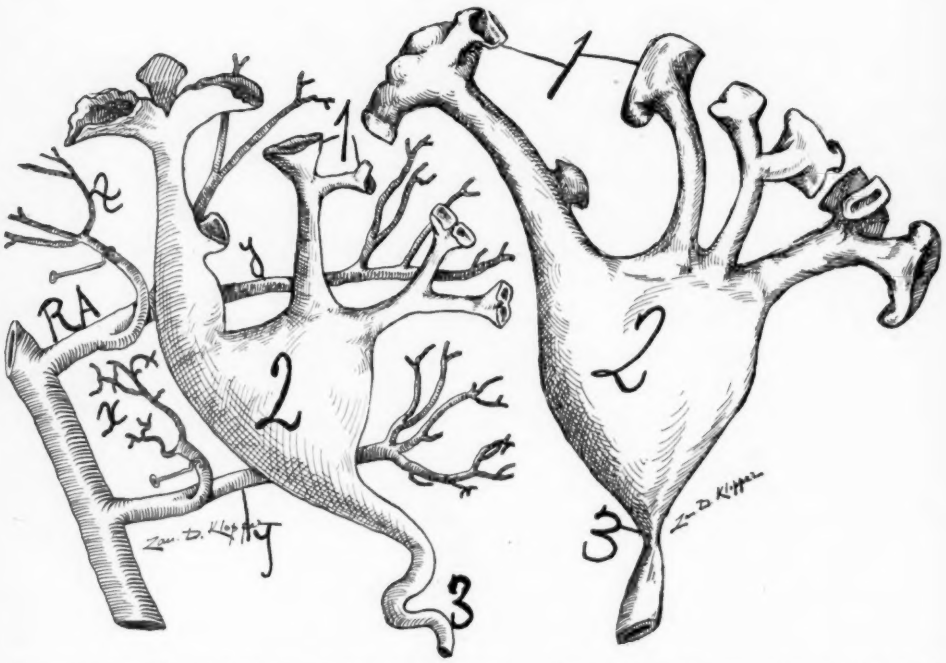

FIG. 22.—Paraffin cast of ureter and renal vessels. Prepared by the corrosive method and sketched from it as a model. 1, calices; 2, pelvis; 3, proximal isthmus. Observe spiral in ureter. Note the larger ventral (y) and smaller dorsal (x) renal arterial vessel. The renal vessels inclose the calices and pelvis within their grasp. The hook draws the dorsal renal branch (x) from the calices to allow the pelvis to be viewed.

Figure (to right). Paraffin cast of: 1, ureteral calices; 2, ureteral pelvis; 3, proximal ureteral isthmuses.

A comparison of forty-five ureters here presented as to calices (1), pelvis (2), isthmuses (3, 5, and 7), and spindles (4 and 6) will reveal a wonderful variation as to the shape, size, location, and multiplicity.

CONCLUSIONS FROM STUDIES OF THE URETERS.

1. The ureter is not a uniform calibered tube.

2. It consists in general of three isthmuses or sphincters located at points in the ureter where projecting adjacent structures compromise; kink its lumen. The ureteral lumen is compromised by: (*a*) the distal renal pole projecting the ureter medianward, producing what I shall term the proximal isthmus, sphincter or neck of the ureter; (*b*) the ureteral lumen is compromised at the point where the vasa iliaca project the ureter ventralward, producing what the author terms the middle isthmus or sphincter, the flexura iliaca ureteris. The middle ureteral isthmus is due to the increased ventral projection of the ureter by the vasa iliaca on assuming the erect attitude (man, erect bimana). Quadrupeds do not possess the middle ureteral isthmus, and consequently less lumbar ureteral spindle. (*c*) The lumen of the ureter is compromised at the point where its distal end penetrates obliquely the muscular wall of the urinary bladder.

3. Compromised lumen by isthmuses or sphincters induce ureteral dilatations—reservoirs or spindles. There is a ureteral reservoir proximal to each ureteral isthmus, *e.g.*, (*a*) ureteral pelvis proximal to the proximal isthmus or neck; (*b*) lumbar spindle proximal to the middle ureteral isthmus; (*c*) pelvic spindle proximal to the distal ureteral isthmus in its vesical wall.

4. The ureteral spindles are more pronounced in woman than in man on account of the proximal and distal arteria ureterica having an excessive or periodic hyperæmia during reproductive life (pubertas, menstruation, gestation, puerperium, and climacterium). Consequently, in senescence, when its proximal and distal arteria ureterica becomes affected with arterial sclerosis or calcification, lack of nourishment will induce pathologic dilatations of the lumbar and pelvic spindles.

5. Calculi lodge at the ureteral isthmuses.

6. Torsion of the ureter or kink may easily compromise the ureteral neck or proximal ureteral isthmus.

7. Surgical interventions on the ureter should be performed at the ureteral reservoirs or spindles on account of ample lumen and wall.

8. Pathologic conditions of the ureter lie mainly in defects of the ureteral wall (inflammatory products, paresis, tuberculosis, etc.) producing deficient peristalsis, or in the mechanical obstruction to the ureteral stream (calculus, kink, torsion, stricture).

9. So long as the ureteral peristalsis is not interfered with, and especially the ureteral stream is not obstructed, the ureters perform their function.

10. However, as soon as any mechanical obstruction to the ureteral stream arises (as kink, calculus, stricture), the non-drainage induces residual deposits with resulting accumulations of bacteria, whence the vicious circle occurs in the tractus urinarius exactly similar to vicious circles arising from obstructions in the pylorus or the biliary ducts.

11. The ureter is an independent organ conducting the urine from the kidney to the bladder by rhythmical waves, regardless of altitude or force of gravity. It is an elongated duct interpolated between kidney and bladder with similar functions to the bladder—a reservoir.

12. The ureter being located in a universally loose areolar bed, and being longer than the distance between its proximal and distal ends, is capable of an extensive range of motion in pathologic conditions or for surgical intervention.

13. The irregular caliber of the ureter, dilatations (reservoirs, spindles), and constrictions (isthmuses, sphincters) is an hereditary heritage from the Wolffian body enhanced by environments.

I wish to express my thanks to Professor W. A. Evans, Drs. Rodney Ludlow, Ida Schell, Wm. E. Holland, Robert Gregg, Eugenie Culver, Elizabeth Brady, Harry Pratt, and Savage for assistance in this investigation.

Bibliography.—G. Schwalbe, Wm. Nagle, Noel Halle, Glentenay, W. Waldeyer, Pantoloni, Luschka, Holl, Martin Mendelsohn.

SUBCUTANEOUS RUPTURE OF THE KIDNEY.

WITH A REPORT OF NINE CASES.

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THE series published below is chiefly interesting from the different grades of kidney injury represented and the variety and character of complications present. The cases described were all observed at the Hudson Street Hospital within a period of three years. I am permitted to publish them through the courtesy of Dr. P. R. Bolton, in whose service they occurred.

Since the early contributions of Rayer (1839-41),[1] Bloch (1873),[2] Ravel (1873),[3] Simon (1876),[4] and the valuable work of Maas (1878),[5] so many complete and accessible papers have been published upon this subject by French and German writers, that there is little excuse for entering it at the present length, beyond the extreme practical interest which these cases always possess and the opportunities they afford for clinical and pathological study.

From the fact that a large number of the milder cases occurring from time to time in hospital and private practice have remained unreported, owing to their comparative unimportance, it is possible that the injury is much more frequent than may have been generally supposed. Delbét,[6] from all sources, has collected 320 cases.

Under the term rupture are included all degrees of injury, from mere contusion of the kidney substance without rupture of the capsule proper to the extreme degrees of laceration and

pulpification of the organ. There are also included rupture of the blood-vessels of the pedicle and rupture of the pelvis of the kidney. Rupture of the ureter in close proximity to the kidney takes on characters that justify its consideration in company with injury to the kidney itself.

Etiology.—The cause of the injury is usually some form of violence directly applied to the abdomen, flank, or back, as a crush, a blow, or a fall from a height, the subject landing against some projecting object. Or the injury may be the result of indirect violence due to the force of the fall alone. Forced flexion of the body by which the organ is squeezed between the lower ribs and the vertebral column may also be a factor. Muscular contraction has also been assigned as a cause in a number of reported cases. E. Küster [7] has devised some interesting experiments in demonstration of the relative parts which two forces—pressure of the lower ribs in the direction of the vertebral bodies, and the hydraulic pressure of the contained fluid in the body and pelvis of the kidney—exert in the production of these injuries.

As a predisposing cause might be mentioned disease or abnormal conditions, making the organ, either from changes in size or structure, more susceptible to traumatic disturbance. Such a condition is represented in Case IX, where a lack of resistance due to a hydronephrosis accompanied by a chronic pyelonephritis permitted extensive hæmorrhage upon violence of probably less degree than is usually required for such an outcome. The part which mere enlargement of the organ in itself plays in rendering it more subject to all forms of violence is evident.

Pathology.—The pathology of these injuries has been studied in detail by Maas,[5] Edler,[8] Tuffier,[9] Grawitz,[10] Herzog,[11] and F. A. Rein,[12] from the results of operations, autopsies, and experiments upon animals. From their observations, the following facts are worthy of note.

Rupture may take place in the substance of the kidney without involving the capsule; or, as is often the case, may include both capsule and kidney substance. The rupture may

involve the larger blood-vessels, the pelvis of the kidney, or the ureter.

The separation of the organ, owing to its structural development, is usually in a transverse direction, though frequently lacerations may be vertical, oblique, stellate, or irregular; or, the organ may be broken into a number of large or small fragments. Further, the organ may be completely crushed or pulpified; or, it may be torn loose from its pedicle and found lying free in the retroperitoneal tissues. Where the capsule is uninjured, the tendency is towards early cessation of hæmorrhage from pressure of the circumscribed clot. Where the capsule is torn, escape of blood is permitted into the loose, subjacent tissues, and if laceration is great, hæmorrhage may be extensive. Where, in addition, the peritoneum is torn, allowing free entrance of blood into the peritoneal cavity, the tendency is towards uninterrupted hæmorrhage.

Laceration of the peritoneum occurs most frequently in children under ten years of age, owing to the non-development of the subperitoneal fat and the close attachment of the peritoneum before this period.

Infection of extravasated products may result in septic peritonitis, in diffuse infection in the kidney, or in abscess formation, either within or adjacent to the injured organ. The avenues of infection are the ureters, the blood and lymphatic vessels; the former two are the usual channels of infection. Where infection occurs by way of the ureter, its source may be a urethritis or a cystitis existent before injury, or may be a more recent septic process kindled through extraneous infection of decomposed blood-clots accumulated in the bladder. The uninjured kidney of the opposite side may also become the seat of disease through a progressive infection of this character.

Where infection occurs by way of the blood, the point of origin may lie in some such distant focus as has been demonstrated to exist in those cases of infection occurring in the course of non-traumatic affections of the kidney; such as a furuncle, a carbuncle, a felon, or an osteomyelitic abscess.

Opposed to the theory of a hæmatogenous infection of an injured kidney are the results of Rinne's experiments cited by Grawitz [10] and Herzog.[11] This observer introduced foreign substances repeatedly into the kidney substance of animals under aseptic precautions, and was unable to secure infection of the involved tissues after introduction of pure cultures of pus-producing cocci into both the blood and peritoneal cavity. That such infection does occur, however, is well illustrated by a case from Israel,[13] which is briefly as follows:

> The patient, after exhibiting typical symptoms of subcutaneous rupture of the kidney with the early development of a palpable tumor mass in the loin and the subsequent advent of septic symptoms, was operated upon on the eleventh day. Incision down to the infected kidney disclosed two abscesses, located behind the hilum and behind the body of the kidney respectively. Cultures from the abscess contents and from the urine, both before and for several days after operation, gave pure cultures of the Bacillus coli communis. There had been an obstinate constipation for six days preceding the development of the infection.

In connection with this case Israel mentions the well-known experiments of Posner, who produced occlusion of the intestines in animals by artificial means, and subsequently demonstrated at the termination of the process a wide-spread invasion of the whole organism by the Bacillus coli communis. The kidneys especially were found to be the seat of bacterial invasion.

Abscess formation is more frequent in the substance of the kidney than in the adjacent tissues. It may have the form of a single abscess cavity or consist of multiple foci. When the abscess has its origin in the perirenal tissues, it may point in the lumbar or inguinal region, or it may perforate into the pelvis of the kidney or the ureter, or into the intestine or the pleural cavity.

Where the pelvis of the kidney is torn, there may be extensive extravasation of urine into the adjacent tissues with the formation, in the absence of infection, of a large retroperitoneal cyst. Such a collection may attain enormous size, as was observed in Case VIII. This condition, sometimes termed

a hydronephrosis, but better a pseudohydronephrosis from the fact that it lies outside the pelvis of the kidney, occurred nineteen times in the table brought together by Delbét.

Symptoms and Signs.—The most constant and characteristic symptoms are pain and hæmaturia. The local pain is always present unless obscured by shock or coma. Occasionally there are present ureteral pains of a colicky character from the passage of clots towards the bladder; or painful micturition may occur from the same cause. The collection of clots in quantity in the bladder, it may be noted here, is infrequent. It occurred only three times in Maas' seventy-one cases. Hæmaturia, while a fairly constant symptom, may be intermittent in character; or it may be late in making its appearance, from several days to two weeks, in reported cases; or it may be altogether absent in rare cases. These variations are usually due to obstruction to the outflow of urine into the ureter by clots, though thrombosis of the renal vessels and tearing of the ureter are also occasional causes, and stricture of the ureter has accounted for the absence of hæmaturia in one instance.[14]

Oliguria is often met with. Anuria occasionally occurs. It is usually due to shock, and secretion is resumed in from twenty-four to forty-eight hours. Where the kidney of the opposite side is absent, injured, or diseased, the condition may persist to a fatal termination. Besides blood, the urine may present casts and large quantities of epithelial débris; and later, if suppuration occurs, pus-cells are found.

Shock is always present in greater or less intensity, and, unless associated with coexisting injuries to other structures, is often a valuable index of the extent of hæmorrhage present.

A temperature varying usually from 100° to 101° F. is very often present during the first three or four days, and considerably higher temperatures are sometimes exhibited without further cause than local tissue reaction.

The presence of a tumor mass is usually recognized with difficulty in the early stages of injury, but the rigidity of the muscles of the back and flank is an early and characteristic

sign. Where hæmorrhage takes place into the peritoneal cavity characteristic signs are often evinced on palpation and percussion. Later, the symptoms of a general peritonitis may be present.

If suppuration occurs in or around the kidney, rigors, temperature, sweating, and, later, exhaustion make themselves evident.

Complications.—For convenience of study, we may divide complications as they are found in this class of injuries into the following heads: They may be due (*a*) to pre-existing abnormal conditions, such as congenital malformations, nephritis, or hydronephrosis; or (*b*) to conditions brought about by changes occurring at the site of injury or in closely related structures, such as extracapsular hæmorrhage, either into or behind the peritoneum, secondary nephritis, and the septic processes; peritonitis, when it occurs as a result of the kidney injury, abscess formation, cystitis, and secondary infection of the opposite kidney; or (*c*) to traumatic lesions of other organs or structures induced at the time of injury, such as rupture of the spleen, liver, and intestines, or fractures and luxations of the bones, or injuries to the brain and cord; or (*d*) to intercurrent affections such as pneumonia, pleurisy, and pericarditis. An example of complication under the first head occurs in Case IX, under the second in Cases IV and VIII, under the third in Cases V, VI, and VII, and under the fourth in Case III.

Diagnosis.—The diagnosis is usually easy and is based on the history of the injury, together with the symptoms of local pain and hæmaturia and the rigidity of the muscles of the back and flank. It is only in the cases where hæmaturia is absent or late in making its appearance, and in those cases complicated with injuries to other viscera, that difficulty in diagnosis presents itself; and in the latter case the difficulty is not as much one of determining the fact of kidney injury, as it is the extent of this injury, and the relative part it plays in the complex of symptoms present. This is often practically impossible without recourse to exploratory incision, as was done in Cases IV and V.

The early employment of the catheter often expedites the diagnosis of a suspected kidney injury.

The diagnosis of extensive hæmorrhage is evident from the well-known train of symptoms incident to internal hæmorrhage; persistent or rapidly increasing shock, thirst, restlessness, and the rapid development of secondary anæmia. It may be still further confirmed by the discovery of a palpable tumor mass in the flank or abdomen.

The diagnosis of septic processes in the peritoneal cavity or within or adjacent to the kidney is usually made sufficiently plain by the train of symptoms belonging to these respective conditions. Bacteriological examinations of the blood and urine may also serve to throw light on a suspected case of infection in the kidney or adjacent tissues.

Course.—In uncomplicated cases the course is usually a mild one. Succeeding the initial shock, after from three to five days of local pain of greater or less intensity, perhaps a slight temperature, and a period of hæmaturia of from two to ten days longer, convalescence is established. The whole duration in ordinary cases is given as anywhere from two to four weeks. Two or three weeks probably represent the average. Occasionally pain persists for a considerable period after all other symptoms have subsided. Edler [8] mentions an otherwise simple case where pain was present as the only remaining symptom for a year after the disappearance of all other symptoms. In a similar way hæmaturia alone or accompanied by pain has been known to persist from six weeks to several months after injury. Typical cases of simple rupture of the kidney treated on the expectant plan are Nos. I and II.

In complicated cases the course varies with the identity of the structures involved and the character and intensity of the lesions. Grawitz [10] gives the causes of fatal termination in the following order: (1) Primary hæmorrhage, (2) Secondary or prolonged hæmorrhage, (3) Septic processes, (4) Suppression of urine from injury, disease, or non-development of the other kidney.

When rupture of the capsule proper of the kidney occurs

and the hæmorrhage is confined to the retroperitoneal tissues, the danger of a fatal termination is much less than when a rent through the peritoneum allows free escape of blood into the peritoneal cavity. When in addition to the kidney other intra-abdominal organs, such as the spleen, the liver, and the mesentery, are torn, enormous and rapidly fatal hæmorrhage often takes place, as occurred in Cases VI and VII.

If the danger of hæmorrhage is safely passed, the advent of sepsis, either early or remote, is to be reckoned with. As stated, sepsis may occur as a rapidly fatal peritonitis, an abscess within or adjacent to the kidney, a diffuse infection of the kidney, or a progressive infection of the urinary tract beginning in the urethra or bladder.

The occurrence of a traumatic nephritis of a non-septic character as a sequel to rupture of the kidney is rare.

In the absence of infection, extravasated products tend either to resorption or, as in the case of rupture of the pelvis or the kidney or ureter, to cyst formation. Rupture of the pelvis of the kidney from pressure of surrounding extravasated products and their spontaneous discharge through the ureter is a termination that has been observed and reported a number of times.[15]

Prognosis.—In the simple cases, accompanied by slight or moderate degrees of hæmaturia and in the absence of evidences of extended extracapsular hæmorrhage, the prognosis is very good, practically complete recovery taking place, usually within a period of from two to three weeks.

In cases with marked extracapsular hæmorrhage, either within or without the peritoneal cavity, the prognosis in the absence of early operation is very grave, death occurring primarily from hæmorrhage, secondarily from septic processes.

In cases complicated with rupture of one or more of the intra-abdominal organs with evidence of profuse internal hæmorrhage, the prognosis is serious in cases adapted to operation; practically hopeless in those left without operative intervention.

Treatment.—The treatment is non-operative and operative.

1. *Non-operative Treatment.*—In simple cases with evidences of only slight or moderate hæmorrhage the treatment is expectant. The patient is placed at absolute rest in bed, with milk diet. Ice-bags are applied over the injured loin and abdomen and morphia administered where required for the relief of pain and restlessness. The use of internal remedies for the control of hæmorrhage, such as ergot, gallic acid, and lead acetate, may also be tried. Where the employment of the catheter is necessary, either for the relief of retention due to clots or for diagnostic purposes, the strictest antiseptic precautions should be observed. Where there is extensive accumulation of clots in the bladder, their removal by means of a suitable evacuator is indicated.

2. *Operative Treatment.*—This has two main objects in view,—the control of hæmorrhage and the prevention of subsequent septic processes at the site of injury. The cases complicated by profuse extracapsular hæmorrhage, either within or external to the peritoneal cavity, and those complicated with injury to other intra-abdominal structures require prompt operative interference.

The conditions that demand exploratory incision after the lapse of the first forty-eight hours are evidences of continued hæmorrhage, persistent anuria, septic symptoms, and a well-defined tumor-mass independent either of evidences of marked hæmorrhage or of a septic process. In the latter case, if no other condition is found present at operation than a mass of extravasated blood and urine, incision is justified, since the removal of such material means the prevention of a possible septic process later.

The incision that practical experience has proven best adapted to all cases of traumatic kidney lesion of the class under consideration is the transverse incision of McBurney, which begins at the outer border of the erector-spinæ muscle and passes forward just below the free border of the ribs to end at about the anterior axillary line. Its advantage is that it gives free access at will to both intra- and retroperitoneal spaces, affords satisfactory inspection of all the intra-abdom-

inal organs when necessary, and can be extended forward so as to give ample room for any manipulative procedures required in dealing with the kidney and its vessels, the spleen, or adjacent structures.

The methods of dealing with the torn kidney in operation for the relief of hæmorrhage consist in suture, packing, and partial or total removal of the organ. Suture is indicated in cases with slight or moderate laceration where the organ is accessible for such manipulation. It may be used alone or supplemented by packing. Packing is indicated in cases of the same character when they are not accessible to suture. Alone or accompanied by suture, it is also indicated in the severer cases where there is extensive laceration, but where disorganization of the kidney has not taken place. It is further used in cases of partial nephrectomy and in those cases of most severe character where, though laceration and disorganization of the kidney is extreme, total extirpation is impracticable, owing to inaccessibility of the organ.

Partial nephrectomy is indicated, first, in those cases where one extremity or pole of the kidney is torn away, but its pelvis is uninjured and its main blood supply intact; secondly, in the cases of extreme laceration just described, where, from inaccessibility of the organ, simple packing, or packing with removal of detached or accessible portions of the organ, must take the place of complete nephrectomy.

Complete nephrectomy is indicated, first, in those cases of extreme laceration and pulpification of the kidney or laceration of its blood-vessels where there is no possibility of its further usefulness; secondly, in cases of more moderate degree, but where hæmorrhage being profuse, shock great, and the organ easily accessible, its removal affords the promptest and most efficient means of hæmostasis.

A further great advantage in primary nephrectomy in cases where a choice might lie between it and apparently more conservative measures is its removal of the possibility of subsequent septic processes in the kidney and the establishment of obstinate urinary fistulæ.

Contraindications for nephrectomy are injury, disease, absence, or congenital malformation of the opposite organ.

Whatever special form of operative treatment is employed in meeting the conditions described, the provision for drainage in every case must be adequate and thorough.

The treatment of so-called traumatic hydronephrosis following injury to the kidney consists in aspiration of the sac, incision, with repair of the injury to the pelvis of the kidney, and nephrectomy. Aspiration is the first measure to be tried, and is to be repeated one or more times, supplemented, perhaps, with injections of iodine. If these measures are not successful, exploratory lumbar incision is to be made, the wound in the pelvis of the kidney repaired, and the sac obliterated and drained. If repair to the pelvis of the kidney prove impracticable, the organ is to be removed either by primary operation, if the sac is small and adhesions not extensive, or by secondary operation after drainage of the sac if it be large or adhesions extensive.

CASE I. *Simple Rupture of Kidney; Conservative Treatment; Recovery.*—Male, aged twenty-nine years; cable-car conductor; on September 22, 1899, was caught and squeezed between two cars, and was removed a short time after the accident to the Hudson Street Hospital. Examination showed a moderate degree of shock, fracture of the ninth and tenth ribs in the left posterior axillary line, and contusion and tenderness over the left lower dorsal and lumbar regions. He complained of great pain in this locality, and a specimen of urine passed a half-hour after admission was dark and smoky and contained a large number of red blood-cells. Examination at this time showed slight rigidity and tenderness of the left half of the abdomen. For several days this condition persisted, and blood was present in the urine in decreasing amounts up to the sixth day. No other symptoms, however, presented themselves, and the patient rapidly improved up to the time of his discharge on the eleventh day.

CASE II. *Simple Rupture of the Kidney; Conservative Treatment; Recovery.*—Male, aged twenty-nine years; driver; on August 16, 1899, was run over by a truck, the wheel passing

across his body from left to right. On admission to the hospital a half-hour later he was suffering a moderate degree of shock and complaining of severe pain in the left flank. Examination showed slight contusion over this locality with some tenderness. The abdomen showed great tenderness over the left lumbar region, and an imperfectly defined area of dulness extending upward and forward from the flank to the anterior axillary line. Temperature was 98.2° F.; respiration, 18; pulse, 92, regular, soft, and fairly full. The first specimen of urine passed two hours after his being placed in the ward was dark red in color, smoky, and contained large numbers of red blood-cells. An ice-bag was applied to the loin, and the patient passed a fairly good night. On the following morning the urine was amber in color and showed very few red blood-cells. On the third day he still complained of pain in the back and flank, but his urine was clear and his general condition good. On the fourth day the general condition was much the same, temperature ranging about 100° F., and pulse of good quality, but examination of the urine showed diffused blood in considerable quantity. On the fifth day the urine was of about the same appearance, but patient was much more comfortable than he had yet been, and his general condition was excellent. On the sixth and seventh days blood in urine was diminishing and patient rapidly improving. On the eighth day he sat up. The urine at this time was practically amber in color, but still showed microscopically a small number of red blood-cells. He was discharged cured on the ninth day.

CASE III. *Rupture of the Kidney complicated with Pleuritis; Conservative Treatment; Recovery.*—Male, aged thirty-nine years; stenographer; on September 20, 1899, was caught between a moving "L" car and the platform rail; while still retaining his feet, he was squeezed through the chest and upper part of the abdomen and rolled and dragged along a distance of several feet. When brought to the hospital shortly afterwards, he showed a slight amount of shock, and complained of pain generally distributed through the lumbar region. He presented a scalp wound, and there was considerable tenderness and contusion over the dorsal and lumbar areas. He was placed in bed, and an hour or so later passed a quantity of smoky urine which disclosed large numbers of red blood-cells on microscopic examination. The night was passed in some pain, relieved in greater part by morphia.

During the following day a slight temperature began to develop, and the urine passed contained considerable quantities of diffused blood. The evening temperature was 101° F.; pulse, 104; respiration, 38. The patient seemed uneasy and restless, and complained of indefinite pain over the right half of the back in the lower dorsal and lumbar regions. He was pale, but there were no evidences of pronounced shock, and his general condition seemed fair. With the possibility in view that these symptoms might be associated with hæmorrhage or intraperitoneal complication, a careful examination was made at this time. Except for slight rigidity and distention, the abdomen was negative. Examination of the right chest posteriorly showed noticeable diminution in respiratory movement over its lower portion, and on auscultation respiratory sounds were found much diminished. On the following morning well marked localized pain on inspiration and the appearance of friction sounds confirmed the presence of a dry pleurisy. Slight temperature and rise of pulse rate continued for several days, and blood was present in the urine in decreasing quantities up to the seventh day. The patient was discharged cured on the eleventh day.

Case IV. *Rupture of the Kidney with Extensive Extracapsular Hæmorrhage; Nephrectomy; Recovery.* — Male, aged ten years; school-boy; on July 11, 1899, while riding on the inside seat of an open trolley-car, was struck in the left side of the abdomen by the protruding pole of a wagon. He walked to the hospital, a distance of several blocks. When seen in the out-patient department, some twenty minutes after the accident, he was pale, covered with a profuse sweat, and was very restless, but complained of no pain, and there was no evidence of external injury. The boy wished to go home, declaring that he was all right; and it was only after some persuasion that his friends permitted him to remain in the hospital. He was sent to the wards and put to bed. Pulse was 104, respiration, 36; temperature, 99° F. Strychnine sulphate, one-thirtieth of a grain every three hours, was ordered, and, as restlessness was great, a hypodermic of morphia was given. Four hours after injury he complained of sharp pain in the left lumbar region, and two hours later, after painful micturition, passed a few ounces of blood-streaked, smoky urine. During the night and during the early forenoon of the following day the pulse gradually became weaker and more fre-

quent, and the patient was accordingly prepared for operation. The urine now passed was clear and free from blood, but the pulse had risen to 116, respiration 36, temperature 101° F. The abdomen was slightly distended and not tender, but there was rigidity of the muscles over the left side of the abdomen, and a poorly-defined area of dulness could be perceived in the left lumbar region of the abdomen.

Operation.—At noon, twenty hours after injury, the pulse was 136, very soft and of poor quality; respiration was 44, temperature 101.2° F. Nitrous oxide and ether anæsthesia was begun at this time; and as the mode of injury, the rapid increment of shock, and the early development of rigidity and dulness in the left side of the abdomen pointed to the spleen as the possible source of greatest hæmorrhage, a small incision was made through the outer border of the left rectus muscle over the splenic area and the abdomen explored. The spleen was found intact, though a few small blood-clots were found scattered free among the neighboring intestines. Posteriorly a large hæmatoma could be distinguished lying behind the peritoneum in the left lumbar region, so the incision was rapidly closed and the patient turned upon his side. The König incision was then made over the left lumbar region, and on piercing the lumbar fascia a mass of fluid and clotted blood welled into the wound. This bloody fluid, amounting in all to about three pints, was quickly sponged away, a large clamp applied to the pedicle, the ureter and vessels in turn tied off, and the organ cut away. At this juncture the pulse was 156 and very thready, and signs of collapse became so urgent that the wound was packed without suture, while intravenous infusion of salt solution was being proceeded with. At the conclusion of the dressings, with free rectal and hypodermic stimulation, the pulse had dropped to 140. Patient rallied quickly from his shock, and at midnight the pulse was down to 124, and he was resting quietly. He made a rapid and uneventful recovery, the incision closing on the twentieth day.

Specimen.—Examination of the excised organ showed a cruciform rent centring on the anterior surface of the organ near the middle of the outer border. Transversely from this point the substance of the kidney was torn through on each side clear into the hilum. Vertically, a tear extended upward to within an inch of the upper extremity of the organ, while in the opposite direction

the tear extended from the central point entirely through the substance of the lower extremity.

CASE V. *Rupture of the Kidney complicated with Rupture of the Spleen; Splenectomy; Recovery.* — Male, aged twelve years; Italian; on the evening of August 21, 1899, fell, and was stepped on by a horse while lying upon the ground on his back, and was brought to the hospital a few minutes later. On admission the boy was in a slight degree of shock and complained of pain in the left lumbar region and flank. He was pale, pulse 92, regular, full, and soft. The abdomen was practically normal in appearance, but there was rigidity and extreme tenderness over the painful region of the back and side. A specimen of urine drawn by catheter for diagnostic purposes was of deep smoky appearance and contained large numbers of red blood-cells. During the night the patient slept quite a little, but awakened at intervals and complained of pain in the back and loin. The pulse ranged between 100 and 116, was regular but not full, and rather too soft. When seen at midnight the abdomen was slightly distended, slight tympanites and rigidity were present, and well-marked rigidity existed over the lumbar region. The tenderness and pain seemed to be more generalized over the abdomen. Flatness was present over the left flank. During the next day the appearance of the abdomen remained about the same, but the general condition of the patient became noticeably worse. By evening he was very weak, restless, and in great pain, and incision was decided upon. Pulse at this time was 104, regular, soft, and somewhat weak; respiration 20.

Operation.—Twenty-four hours after injury, under nitrous oxide and ether, a vertical incision was made through the outer border of the left rectus muscle a little below the free border of the ribs, and on opening the peritoneum a few loose blood-clots and some free blood were encountered. On further inspection the spleen was found ruptured, its lower one inch being practically torn away. A clamp was applied to the torn surface and the abdominal cavity washed free of blood-clots with saline solution. While this was being done, a fair sized hæmatoma could be observed lying behind the intact peritoneum over the region of the left kidney. After the cleansing of the abdominal cavity was completed, the pedicle of the spleen was tied with catgut, the organ removed, and the wound closed with a single small gauze drain

passing to the site of the stump. A good recovery was made from the operation, and on the following day the patient presented a much improved pulse and a promising general condition. The urine was smoky, dark, acid; specific gravity 1026, with a trace of albumen, epithelium, and large numbers of red blood-cells. On the third day the urine was clear, with a trace of albumen and a diminished number of red blood-cells. On the fourth day the urine showed very few red blood-cells and the patient was steadily improving. By the ninth day, when the sutures were removed from the abdominal wound, the urine was found clear and free from red blood-cells, but $^1/_{10}$ per cent. of albumen by volume was present. Beyond some sleeplessness and other general nervous manifestations and the presence of a slight trace of albumen in the urine, the patient showed no further abnormal symptoms up to the time of his discharge on the twenty-fifth day. He has been seen at the hospital many times subsequently, and is apparently enjoying the best of health.

CASE VI. *Rupture of the Kidney complicated with Rupture of the Spleen; Splenectomy; Death from Primary Hæmorrhage and Shock.*—Male, aged thirty-two years; Italian; street cleaner; on October 15, 1901, at about midday, was knocked down and fell under the front wheel of a truck, which pushed him along for several feet and held him pinned to the pavement, but did not pass over his body. On admission he was conscious, suffering from considerable shock, and complaining of great pain in the left side of the abdomen and back. Temperature, 98° F.; pulse, 80; respiration, 28. He showed great general pallor, and some fulness appeared to be present over the left side of the abdomen. Palpation gave marked tenderness over the entire left side of the abdomen and over the lumbar region posteriorly, and the left half of the abdomen was markedly rigid. There was dulness in the left axillary line from the sixth rib to a distance of two inches below the free border of the ribs. Catheterization obtained a quantity of very bloody urine, and after the withdrawal of the catheter blood continued to be expelled from the urethra, a considerable amount being lost in this way. By night a marked degree of shock was present. Pallor was most intense. Pulse was only 92, but noticeably weaker than on admission. The temperature had risen to 100.2° F.

Operation.—Seven hours after injury, under nitrous oxide

and ether, a long transverse incision was made through the left lumbar region just below the free border of the ribs. On opening the peritoneum, the abdominal cavity was found filled with blood, and a much enlarged spleen extensively lacerated and partially torn from its peritoneal attachments. Bleeding surfaces were secured as rapidly as possible by means of clamps, ligatures, and sutures, the pedicle of the spleen tied off, and the organ cut away. The abdominal cavity was then repeatedly washed with salt solution and an enormous quantity of blood washed away. No other points of intraperitoneal hæmorrhage were found, and it was evident that hæmorrhage must have been very free from the torn surfaces of the spleen and from the lacerated pedicle and attachments. A large hæmatoma lay in the retroperitoneal tissues over the left kidney; but in view of the great loss of blood that had evidently taken place into the abdomen and the condition of the patient, it was unadvisable to continue operative interference further. The patient left the operating room with a pulse of 160, in spite of infusion and free stimulation. During the following day there was progressive collapse, and death occurred thirty-six hours after admission.

No autopsy.

CASE VII. *Rupture of Kidney; Rupture of Mesenteric Vessels; Operation; Death from Primary Hæmorrhage.*—Male, aged twenty-three years; a driver; while at work on the afternoon of July 7, 1900, became caught between two trucks, which squeezed his body from before backward, his abdomen receiving the brunt of the contusion. He was brought to the hospital in a state of extreme collapse, pulse very rapid and shallow, air hunger marked. There was great paleness of the entire body. No abrasion or other injury was apparent upon the surface of the abdomen on inspection, but pressure showed great tenderness. Morphia was administered and free stimulation with strychnine and whiskey was begun. A specimen of urine obtained an hour and a half after injury contained a large quantity of diffused blood. As collapse continued, sixty-four ounces of salt solution were infused eight hours after injury, and hypodermic stimulation was made very free. Pulse at this time was 148 and quite weak. An hour and a quarter later, a saline enema of thirty-two ounces was given, and a half-hour later a second infusion of sixty-four ounces. Patient was sent to the operating room nine and a half hours after

injury with a pulse of 148 and respiration 50. Under cocaine anæsthesia the abdomen was opened in the midline. On incising the peritoneum, there was an escape of considerable gas and some odor, and a large quantity of blood welled into the wound. The intestines were examined, thoroughly washed, together with the remainder of the abdominal contents, returned, and gauze drainage inserted. The incision was only partially closed, and the patient returned to the ward with a pulse of 124 and respiration 24. An hour later the pulse had risen to 180, and death occurred twelve and a half hours after injury.

Autopsy.—Showed a red, congested, and somewhat opaque peritoneum. The mesentery showed at one point near its attachment a laceration six centimetres in length. Mesentery, mesocolon, and the retroperitoneal tissue, especially that of the right side, were distended with effused blood. The right kidney was of normal size, pale, and flabby. Its anterior surface was marked by a number of lacerations varying in length from a third to a half centimetre. Both large and small intestines showed numerous small areas of submucosal hæmorrhage.

Case VIII. *Rupture of Pelvis of Kidney; Formation of a Large Retroperitoneal Cyst (Pseudohydronephrosis); Nephrectomy; Recovery.*—Male, aged thirty years; printer; on the evening of April 28, 1900, was knocked down and run over by a truck, and was brought in the ambulance to the Hudson Street Hospital. On admission he gave no evidence of serious injury, and showed merely rather extensive contusion of the back in the left lumbar region. He complained, however, of great and continuous pain in this locality, and this persisted to some extent on the following day, when at his own request he was allowed to return to his home in Brooklyn. No other untoward symptoms were observed during his stay overnight in the hospital, though the urine was not examined. Two and a half months later the same patient was admitted to Dr. Bolton's care at Bellevue Hospital with the following interesting recital. After leaving the Hudson Street Hospital and returning home, he endured three or four days of continuous pain, and then sought relief at a Brooklyn hospital. Here he was put to bed for two weeks with an ice-coil upon his abdomen, and at the end of this time, the pain being somewhat relieved, was allowed to go home again. But after remaining at home for three days, the pain recurred with so much severity that

he returned to the hospital. This time an incision was made in the left side of the abdomen, and he was told a clot of blood had been removed from the intestine. In three weeks he was up, and was about to go home, when a swelling was noticed in the left side of the abdomen. Thereupon a long needle was inserted below and to the left of the umbilicus, and four quarts of clear, yellowish-white fluid were withdrawn, and he was allowed to go home on the following day. Four days later he noticed that the swelling had reappeared, and in a week's time the abdomen was so distended, pain and difficulty in respiration so pronounced, that the patient applied to Bellevue Hospital for admission June 27, 1900. On admission, inspection of the abdomen showed an ovoid tumor, apparently eight or nine inches long, occupying the left side of the abdomen, with its long diameter vertical and its centre about four inches from the midline. The left side of the abdomen bulged markedly, the skin over the tumor was tense and shiny, and the cutaneous veins over the iliac region were noticeably distended. A bright red vertical scar five inches long extended from the lower border of the twelfth rib on the left side to the crest of the ilium at its posterior third. On palpation the tumor was found to fluctuate, and the abdominal wall was apparently movable over it. Percussion gave flatness over the whole left half of the abdomen, tympany over the right.

Operation.—On June 29, under ether anæsthesia, an incision seven inches long was made obliquely downward and forward from the edge of the erector-spinæ muscle into the left lumbar and iliac regions. On penetrating the lumbar parietes, there was a profuse gush of fluid from beneath. This fluid was evacuated and amounted approximately to two gallons. It was watery, red, opaque, and odorless. The sac was irrigated with hot salt solution, and a hand introduced within it found a cavity extending upward to the subphrenic region, downward into the iliac fossa, and inward to the vertebral column. On the anterior surface of the sac and close to the spinal column was discovered an oval, flattened body, which presented a depression on its inner border. This was thought to be the left kidney, and it appeared to be slightly enlarged. The sac was drained by rubber tubes and iodoform gauze packing and the wound closed. At the end of two months' time the site of the drainage tube had diminished to a small fistula, which continued to discharge clear urine; there

had been no recurrence of the tumor. A second operation was then determined upon for the removal of the kidney.

Operation.—Accordingly, on August 31, four months after injury, the patient was again placed under ether and a transverse incision seven inches long made in the lumbar region. A probe that had been passed from the mouth of the fistula through the shrunken sac was found to enter the pelvis of the kidney. The organ, on being partially freed from its very firm adhesions to the anterior wall of the cystic sac, was found to be of normal appearance. It was attempted to so free the kidney as to expose and suture the opening in its pelvis, but, owing to the extent and firmness of adhesions, this was found impossible, so the organ was removed. A rent in the peritoneum where the kidney had been adherent was closed with catgut sutures, and the sac then obliterated by deep muscular sutures of chromic gut. Iodoform gauze drains were then inserted down to the pedicle stump and the incision closed. On the following day the drains were removed. By the seventh day the wound was closed and sutures were removed. The patient made a subsequent uninterrupted recovery. He has been seen a number of times since at the hospital and his health is apparently normal.

Case IX. *Rupture of a Hydronephrotic Kidney; Nephrectomy; Recovery.*—Male, aged thirty-five years; a baker; applied for admission to the hospital, September 11, 1901, with the following history. Four days previous he had been violently struck with a club over the left hypochondrium. He felt severe pains following the injury, and went the same day to a well-known dispensary for treatment. It was found there that he had a fluctuating swelling in the left side of the abdomen, and that there was a large quantity of blood present in his urine. The character of his injury was diagnosed, and he was advised to go to a hospital for treatment, which he did only after remaining at home for three days and suffering greatly from pain, accompanied with hæmaturia and with no diminution in the size of the tumor. On admission he stated that he had always enjoyed good health, and that he had never to his knowledge suffered from any previous injury or disease bearing upon the genito-urinary tract, that he had no knowledge of the former existence of a tumor, and that, so far as he knew, his urine had never presented any abnormality in quantity or appearance. Examination showed a well developed,

well nourished man. The chest showed a well marked anterior bulging at its lower portion on the left side and loss of fremitus, with flatness from the sixth rib down to the free border. The abdomen showed a well marked prominence continuous with that of the chest, extending from the left hypochondriac region downward and inward nearly to the umbilicus. The swelling gave on palpation the sensation of a large, elastic, slightly fluctuating tumor apparently extending upward beneath the free border of the ribs. The urine showed the admixture of so much blood that its appearance was almost that of pure blood itself. It was voided in nearly normal quantity. Admission temperature was 100.6° F.; respiration, 36; pulse, 88.

Operation.—On the following day, five days after injury, under nitrous oxide and ether anæsthesia, a transverse incision eight inches long was made just below the free border of the ribs, extending from the outer border of the erector-spinæ muscle anteriorly into the left hypochondriac region. On separating the lumbar fascia an enormously dilated cystic kidney was found. It was punctured with an aspirating needle and sixty-five ounces of bloody urine were withdrawn. The kidney was then separated from its peritoneal adhesions, its pedicle tied, and the organ removed. Iodoform gauze packing and suture completed the operation. Following operation, the temperature rose to 103° and 104° F., where it continued for thirty-six hours, and then fell to normal. The pulse during this period was 124 to 136. Patient made an uneventful recovery, except for an irregular temperature, together with urine of a low specific gravity and about 5 per cent. albumen by volume up to the fortieth day. On his discharge on the fiftieth day the operation sinus had closed; he was in good physical condition, and his urine showed a specific gravity of 1011, $^1/_{20}$ per cent. albumen by volume, and no casts.

Specimen.—Examination of the specimen removed at operation showed an enormously distended kidney, measuring twenty-two by fourteen by ten centimetres, with very thin walls, and divided into three loculi, two of which communicated directly with the pelvis. The pelvis was enlarged, but the obstructing cause was not present in the portion of the tract removed. No gross traumatic lesion could be found, but section of the cyst wall showed, in addition to a chronic pyelonephritis, many small but widespread areas of hæmorrhage into the submucosa.

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TRAUMATIC RUPTURE OF THE SPLEEN.[1]

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RUPTURES of the spleen, without external signs of injury, are more frequent than those due to gunshot or stab wounds. Edler found in 160 cases 51.8 per cent. were due to external violence without local signs, 26.2 per cent. were gunshot wounds, and 21.8 per cent. were stab wounds. Pathological spleens are more prone to rupture, even when the trauma is comparatively slight, than normal ones. Of 131 cases of splenic rupture collected by Lewerenz, 82 occurred in pathological organs. Of this entire number the injury was severe in only eighty, slight in fifty, and absent in five. It is a well-known fact that rupture of the spleen is very apt to occur in tropical countries. One observer noted over twenty cases where the spleen had been previously enlarged by malaria.

Surgical Anatomy.—The spleen lies quite deeply in the left hypochondriac region. Its posterior end extends almost to the spinal column at the level of the tenth dorsal vertebra; its anterior or lower end extends as far forward as the costo-clavicular line (junction of the left sternoclavicular articulation and tip of the eleventh rib). Its outer convex surface lies against the side of the thorax from the ninth to the eleventh ribs, being separated from them only by the diaphragm and the lower border of the left lower lobe of the lung. Its inner surface is in contact with the upper pole of the left kidney and the fundus of the stomach. It is also in contact with the tail of the pancreas at the hilus. It is suspended principally by a ligament which extends from the diaphragm to the colon (phrenocolic); it is also connected with the

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stomach and kidney by folds of the peritoneum. All of these give it but little fixation. The splenic artery and veins enter the organ at the hilus, which is directed towards the median line, and are its sole blood supply. They run along the upper border of the pancreas between the two layers of the gastro-splenic ligaments. The best incision for the removal of the spleen is one through the outer border of the left rectus muscle, beginning at the costal arch.

Frequency and Manner of Injury.—From the well protected position of the spleen behind the ribs, one would scarcely expect it to be frequently injured. But this is not borne out by clinical observations. In 292 cases of injuries of varying degrees of severity of the abdominal viscera, Makins found eighty-nine cases of rupture of the viscera. The largest number were those of the kidney (39 per cent.); next were those of the liver (23.59 per cent.), and third, those of the spleen.

The variety of trauma producing rupture of the spleen varies greatly, but may in general be described as due either to a localized force (*e.g.*, a horse-kick, or striking the splenic region with some blunt instrument, as a hammer), or to some force which crushes the thorax and abdomen in an antero-posterior or lateral direction (caught between cars or being run over). The former group is far more frequently the mode of production of the injury than the latter. It may occur at any age and in both sexes, showing that the greater elasticity of the lower ribs in youth plays no rôle. In fifty-three cases in which I could ascertain the cause, a fall upon some object or being struck or kicked was more often the cause than a crushing force (run over), the former in forty-two, the latter in eleven cases.

Symptoms.—The symptoms of a rupture of the spleen vary somewhat in different cases, but correspond in general to those of a grave abdominal injury. In the cases which I have collected, in almost every case there were certain more or less pathognomonic symptoms. *First,* severe pain most frequently referred to the left hypochondriac region. *Second,* sooner or later signs of internal hæmorrhage or of collapse.

It is true that there are exceptional cases in which there is but little change at first, the signs of hæmorrhage coming on rather late (in one case on the fourth day). Such hæmorrhage may come on late as the result of dislodgement of the clot. *Third,* one of the most characteristic symptoms is dulness in the flanks, especially on the left side, changing with change of position. *Fourth,* some French surgeons and Trendelenburg have laid great stress upon rigidity of the abdominal muscles upon the side of injury as a valuable sign of rupture of one of the abdominal viscera. It may be said in general, that when a patient has met with either a circumscribed or diffuse mode of injury, and has recovered from the primary symptoms of shock, but continues to have the symptoms of internal hæmorrhage and localized pain, and does not recover from the same within six to twelve hours, a diagnosis of an injury of the spleen or liver, or rupture of the kidney, with hæmorrhage into the peritoneal cavity, may be made. It is almost impossible to differentiate between hæmorrhage from a rupture of the spleen and liver or those intraperitoneal hæmorrhages due to the free communication between the seat of rupture in a lacerated kidney and the general peritoneal cavity.

The following case will serve to illustrate the subject:

J. Z., aged ten years, was brought to the Cook County Hospital at 4 P.M., and admitted to the service of my colleague, Dr. A. P. Heineck. Two hours before admission, a monkey-wrench had been thrown at him during a quarrel, striking him in the left hypochondriac region. He fainted, but recovered consciousness within a few moments, and was able to stand until shortly before he was brought to the hospital. I did not see him upon admission, but responded to a call, in the absence of Dr. Heineck, about nine hours after the injury. His pulse was 96, full and regular; there were extreme pallor, restlessness, and thirst. The abdomen was slightly tympanitic; distinct dulness in the flanks, especially on the left side, changing slightly with change of position. A laparotomy was performed immediately, and upon opening the peritoneal cavity an enormous quantity of clotted and fresh fluid blood escaped. The incision was made over the left

border of the left rectus, which at once exposed the spleen, and an extensive tear was found traversing its entire lower border, from which there was free hæmorrhage. There was also a tear in the omentum. I attempted to suture this tear, but on account of the friability of the tissues my sutures would not hold. The spleen was then extirpated without difficulty. The patient seemed to do well for two days after the operation, and the anæmia began to decrease gradually. He died on the third day. The coroner informed me that the cause of death was a septic peritonitis, but that there had been no further hæmorrhage.

Prognosis.—The prognosis in general of rupture of the spleen, without operative interference, is bad. In 101 fatal cases collected by Lewerenz, out of 135 cases of rupture of the spleen, hæmorrhage was the cause of death in 85 per cent. within twenty-four hours. I have collected fifty cases of laparotomy for rupture of the spleen, of which twenty-eight recovered and twenty-one died. Of these cases, the time intervening before the operation is not given in a number. In the remainder, seven were operated upon within six hours, five within twelve, five within twenty-four, and one within thirty-six hours. Three cases were operated upon on the fifth, eighth, and eleventh days respectively. Of the cases which were operated upon and died, seven were operated upon within six hours of the injury, and of these three died of acute anæmia, and one of pneumonia; two were operated on within twelve hours after the injury, one died of peritonitis, the other of anæmia. Four were operated upon within twenty-four hours, one died of delirium tremens complicated by peritonitis, the other of shock, and two of peritonitis. Two operated on within thirty-six hours after the injury, one already had peritonitis, and one died of anæmia. Two operated on within forty-eight hours died of extensive peritonitis and anæmia respectively One operated upon on the fifth day died of septic peritonitis. Taking all of these latter into consideration, it will be seen that the prognosis can be greatly improved if the cases are operated upon within six to twelve hours after the injury.

It is interesting to note that of the cases which recovered, twenty-seven of the twenty-eight were operated on since 1895, and of those which died, thirteen. It may be said, in general, that the earlier the diagnosis is made the better the prognosis. I do not deny that there are cases which recover spontaneously, but they are rare; and, although the patient may recover from the immediate effects of the hæmorrhage, there is great danger of sepsis later.

In order to demonstrate how operative measures have improved the mortality, it is interesting to study the cases which have been reported up to the present time. Up to 1890, three cases were operated upon, all of which died. From 1890 to 1900, thirty-four cases were operated upon; of these twenty recovered (58 per cent.) and fourteen died (41.2 per cent.). From 1890 to the present time (1902), fifty-three cases were operated upon, of which twenty-eight recovered (52.8 per cent.) and twenty-one died.

Treatment.—The treatment should always be operative, either splenectomy, suture, or tampon. It has been found that the removal of the normal spleen causes but slight, if any, changes in the organism. There is occasionally a little glandular swelling and a moderate anæmia.

The experience which I had in my case demonstrated that it is almost impossible to suture a laceration of any extent, so that one must resort either to tamponing the tear or to the removal of the spleen. It is advisable to tampon if the tear is located on the convex surface or one of the borders and does not extend very deeply into the parenchyma, but is contraindicated if the tear is either deep at this place, or there is extensive pulpification of the spleen, or, lastly, if the tear involves the hilus of the organ. Under these conditions, it is far safer to perform splenectomy. At the time of operation one should have a clear conception of whether the force was circumscribed or diffuse, and an effort at a fairly accurate diagnosis of the viscus injured must have been made by the operator before opening the abdomen.

When the abdomen is opened and reveals an extensive intraperitoneal hæmorrhage, the chief sources of this—liver, spleen, and kidney—must be looked for in the order named. Digital compression of the splenic vessels will check the hæmorrhage temporarily until the location of the tear and mode of procedure can be decided upon.

THE TRANSDUODENAL ROUTE (DUODENO-CHOLEDOCHOTOMY) IN CASES OF IMPACTION OF GALL-STONES IN THE LOWER PORTION OF THE COMMON DUCT.

WITH REPORT OF A CASE OF CHOLEDOCHOTOMIA TRANSDUODENALIS WITH CHOLEDOCHODUODENOSTOMIA INTERNA.

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Since McBurney's[1] ingenious idea and advocacy, in 1891, of the removal of gall-stones impacted near the papilla by dilatation and incision into the papilla after opening of the duodenum, this operation, called by Pantaloni, *Lithectomie Choledochienne per Voie Duodenale,* has been already performed up to 1899 twenty times, with two deaths, as cited by Kocher.[2]

In some of these cases an incision into the papilla, as advised by McBurney, was unnecessary, and the impacted stone could be removed by simple dilatation of the papilla by forceps (Collins's method). It is natural that in cases where, after opening of the duodenum, the stone is found lying near the papilla, or in the interparietal part of the duodenum in the neighborhood of the papilla, the method cited above is the method *par excellence.* But in other cases where the stone is impacted and lies immovable a little higher up in the retroduodenal portion of the common duct, and access by supraduodenal choledochotomy is unadvisable because of tense adhesions or other circumstances, to which I will recur later on, in such case one has, after opening the duodenum, to incise the posterior wall of the duodenum and the common duct on that place which appears to be the nearest for reaching the stone without

previous search for the papilla. This method — claimed by Kocher as being first performed by him in 1894, and later on successfully by Kehr and Mayo Robson with good results—is called by Pantaloni—to whom we owe an excellent description of the various methods of operations performed on the bile passages by way of the duodenum—choledochotomie transduodenale.

As the question of advisability of duodenocholedochotomy has not yet been settled as to universal agreement, the contribution of a case operated by the author seems worthy of consideration, and may form another link in the chain on which to base future definite conclusions.

About the 3d of February, 1902, I was called into consultation by Dr. S., Fredonia Station, Wisconsin, to see a lady fifty-three years of age, who had been complaining for about five to six years of severe attacks of pain in her epigastric region. Twelve months before a sudden attack of pain had set in which was so violent that she fainted. From that time, that is for twelve months, she had been intensely jaundiced, her bowel movements looked gray and smelled stronger than before, and she lost 102 pounds in weight during the year. From the sudden onset of the jaundice, and as no swelling of the gall-bladder was perceivable during examination, I made the diagnosis of complete obstruction of the common duct by gall-stones, which had already lasted for twelve months.

After eight days' preparation in my hospital, during which time I administered six grammes of chloride of calcium daily, and gelatin solution into the rectum (10 to 100) each day for three days previous to the operation, to avoid hæmorrhage during and after operation, I operated on the 18th of February, kindly assisted by Drs. O'Brien, Boden, and John; narcosis, Dr. Sickles.

A large bag was put under the liver of the patient, and then the abdomen opened by a longitudinal incision on the outer border of the rectus muscle. After freeing some adhesions with the omentum, the gall-bladder and a part of the cystic duct were found transformed into a rocky-like mass of the size of two thumbs, the gall-bladder containing not a drop of fluid. After a large incision into the thickened wall of the gall-bladder, this

mass, which appeared to consist of numerous gall-stones welded together, was dug out, and a gauze sponge put into the bladder to avoid oozing into the abdominal cavity during operation. Then a transverse incision through the rectus muscle and the suspensory ligament of the liver was made to gain better access to the region of the common duct. Putting one finger into the foramen of Winslow, and the thumb of the same hand above the common duct, the choledochus was explored. Three concretions were found movable in this duct, and besides that, a hard mass of the size of a hazel-nut was encountered behind the duodenum in the retroduodenal portion of the duct. As several manipulations to dislodge this concretion into the supraduodenal portion of the common duct proved futile, the duodenum was incised by a longitudinal incision on the anterior wall. Then, as I could not find the papilla immediately, an incision was made through the posterior wall of the duodenum and choledochus to this immovable concretion, after having brought the movable stones downward to the impacted stone, holding them tightly in this position by the index-finger of the left hand introduced into the foramen of Winslow, and the thumb of the same hand pressing the upper portion of the common duct.

With some difficulty the incarcerated stone was dug out of its diverticulum; the other stones were easily stripped into the duodenum, the duodenum and choledochus sutured together with four silk sutures (choledochoduodenostomia interna), and then the duodenum on the anterior wall closed in the usual manner. The gall-bladder was drained with a drainage tube after Poppert's method, and a strip of iodoform gauze put around this tube and down to the suture of the duodenum. The patient made an uneventful recovery; her pulse and temperature were never over 100; the fistula from the gall-bladder closed by itself five weeks after the operation. She left the hospital six weeks after operation, her weight increasing rapidly (thirty-seven pounds in four and one-half months).

When I cited this case briefly at the last meeting of the American Medical Association, in a discussion following the papers of Tinker, Baltimore, and Fergusson, Chicago, Dr. Ransohoff, Cincinnati, remarked that the transduodenal route had to be discarded because of the danger of post-operative infec-

tion. Unfortunately, he did not cite on what experience of his own this wholesale rejection was based. The opinion that the death-rate after duodenal choledochotomy would be larger because of the danger of sepsis than after supraduodenal choledochotomy, seems to me to have spread in consequence of the paper of Mayo Robson in *The Lancet*,[3] who expresses himself thus: "Reaching the common duct through the open duodenum, a modification of choledochotomy seemed to me, when it was first suggested by McBurney, an easy and ideal operation, and at that time it was easier than ordinary choledochotomy; but I feel sure that there is a greater danger of sepsis by this method, owing to the necessary enterotomy; and since I have adopted my modification of choledochotomy I have not repeated the operation through the duodenum, and I am quite clear that it is not only more difficult and more dangerous, but that it does not afford so great a facility in clearing the whole of the ducts of concretions. I have performed it eleven times with three fatalities, which compares unfavorably with the ordinary choledochotomy."

In my introduction I have already cited one statistic of duodenal choledochotomies collected up to 1899, as cited by Kocher,—twenty cases with two deaths. Tinker cited at the last meeting of the American Medical Association two cases; Mayo in Rochester,[4] one case; and Robinson [5] two cases without mortality. By private information at the last meeting of the American Medical Association, I was kindly informed by J. B. Murphy that he used the method once, and A. H. Fergusson twice, without fatality. This would make, including the case cited by myself, twenty-nine cases with two deaths, which equals a little less than 7 per cent. In other words, this percentage is not far from that given by Mayo Robson as future possible reduction of mortality when choledochotomy is performed with due precautions after his method, that is, 5 per cent. (*vide The Lancet*, April 12, 1902).

It must be stated, however, for comparison, that before 1900 his death-rate in choledochotomy was 23.8 per cent., and in those operated after January 1, 1900, 7.1 per cent. Fenger

collected in 1896 forty-four cases of choledochotomy, with a mortality of 18 per cent., as cited by Haggard.[6] Petersen[7] cited at the Surgical Congress in Berlin, 1898,—from Czerny's Clinic,—twenty choledochotomies with four deaths, that is, 20 per cent.; and Haasler,[8] from von Bramann's Clinic, under seventy gall-stone operations, eighteen operations on the common duct with two deaths.

I am certainly not convinced of the truth of the words of Talleyrand: "*Messieurs, la statistique c'est le mensonge en chiffres.*" I am of the opinion that these small figures, as given above by Mayo Robson against the advisability of duodenal choledochotomy, and by me in favor of it in suitable cases, do not prove much, if anything, pro or contra, and are too small for forming definite conclusions. But so much I think must be admitted, that the fatalities in duodenocholedochotomy, as shown by my statistics, are by no means higher than those given in the statistics of ordinary choledochotomy. (Unfortunately, I have not the library at hand from which to collect all the cases from the world's literature, therefore it must be excused if my collection is incomplete, and my statistic may be taken *cum grano salis.*)

With full justification, Riedel[9] has pointed out that those cases, where severe infection of the bile passages has taken place *before operation,* are the cases of mortality by sepsis after operation. These people die whether or not one resorts to transduodenal choledochotomy or supraduodenal choledochotomy, or other methods. The most experienced surgeon is, under such conditions, absolutely at the mercy of the virulence of the bacteria and toxins, no matter how brilliant his technique may be. When we compare the statistics of choledochotomy of recent date with the statistics given in former years, we will find that in general more or less decrease of mortality is perceivable. This must be attributed to, first, the development of technique and advanced knowledge of the pathological conditions present; second, to the care and preparation of the patient before operation (chloride of calcium and gelatin solution in cases of jaundice), during operation (large sand bag under the

liver without or together with a position which reminds me somewhat of Walcher's position for contracted pelvis), and after operation; third, to the advanced experience of surgeons in this line of work; and last, but not least, to the employment of drainage in gall-stone surgery, as pointed out by Fenger,[10] Quénu,[11] and Fergusson. The latter surgeon collected ninety-five cases of suture of the duct with a mortality of 35.5 per cent., while the mortality in cases without suture was only 18 per cent. (*vide* Haggard[12]). This by the way.

That it is oftentimes extremely difficult and not seldom dangerous to remove stones impacted in the retroduodenal portion of the common duct from those places where they are usually found, that is, near the opening of the papilla, or before the diverticulum of Vater, or before the pancreatic portion of the common duct, by supraduodenal choledochotomy, is best illustrated by two cases cited by Mayo of Rochester[13] in his recent article in the ANNALS OF SURGERY: "Analysis of 328 Operations upon the Gall-Bladder and Bile Passages." He cites that in two cases energetic attempts to remove all stones from the lower end of the duct, or a diverticulum from it, resulted in forcing the finger well into the duodenum, probably at an adjacent point rather than at the site of the papilla. One of these patients died later on from the consequences, which produced a duodenal fistula. There is no question that by working in the dark from the supraduodenal incision down to the duodenum with scoops, forceps, and sounds, severe damage may be inflicted upon the tissues of the common duct, pancreas, and duodenum, chiefly when ulcers are present, produced by the long-continued pressure of the stone, and that thereby sources for future infection are opened. Furthermore, fragments of stone can be left, thereby paving the way for future recurrence of the obstruction; and a cancer near the papilla, if in its initial stage, could never be detected by this route.

Even if one is enabled to pass a sound down into the duodenum, as advised by Robson, it is thereby not always demonstrated whether the sound passes through the papilla or has perforated the duodenum at another spot.

Fergusson advised, at the last meeting of the American Medical Association, a method of pumping air through the retroduodenal portion of the common duct into the duodenum, to prove the permeability of the papilla. This method is open somewhat to the same objections; and, besides, air can oftentimes pass by the stone.

One has pointed out that it would be difficult to clean out from the duodenum all the stones in the common duct when lying in the supraduodenal portion or in the hepatic duct. The following considerations speak somewhat against it: When a stone is impacted in the retroduodenal portion of the common duct, and more or less complete obstruction has taken place for some time, the common duct usually becomes dilated; and if there are other stones lying higher up, they are generally movable, and can, after removal of the impacted stone, be easily stripped down into the duodenum by putting two fingers of the left hand into the foramen of Winslow, and the thumb above the duct, as urged by Deaver [14] and others. In my case I found it very easy to remove the three stones lying behind the incarcerated concretion, because I had already, before incising the duodenum, stripped them down to the impacted stone, and held them tightly in this position to avoid their slipping back after opening and collapse of the duct. I think this procedure advisable.

At the German Surgical Congress in 1898, Haasler[15] cited another method of removing stones from the retroduodenal portion of the common duct, which he calls retroduodenal choledochotomy, and used three times in eighteen cases of stones in the choledochus. This operation is performed in the following manner: "Longitudinal incision into the anterior layer of the ligamentum hepatoduodenale, near and parallel to the duodenum. Care must be taken to avoid by the incision a branch of the arteria pancreaticoduodenalis running in this direction. By blunt dissection the duodenum can now be severed for a distance of from two to three centimetres and retracted to the left side, whereby the retroduodenal portion of the common duct, covered more or less by the pancreas, is brought into

view. Vautrin proposed to divide the pancreatic tissue by the thermocautery, but this method was not followed in von Bramann's Clinic. In one case they incised the pancreas with the knife, and in the two others the lobes of the glands were severed by blunt dissection at that place where they form a ring around the anterior wall of the duct. Thus the common duct was brought into view and incised.

" For cases of stone impacted in the papillary portion of the duct, he thinks intraduodenal operation the best method, if it is not possible to dislodge the stone and press it into the duodenum. He succeeded twice in doing this, and once intraduodenal operation was necessary, the stone pressing the papilla far into the duodenum, so that it made the impression of a polypus body. Recovery took place in all three cases."

It seems to me that this retroduodenal choledochotomy is more difficult than the transduodenal operation; and beside that, incisions through the pancreatic tissue might be followed by pancreatitis and necrosis.

It is true that cases where stones are absolutely impacted in the retroduodenal portion are not very numerous, and in every case it must be tried first to dislodge the stone up to the supraduodenal portion. This will always be found possible in cases of so-called ball-valve stone of Fenger; and Kehr [16] cites that in most of his cases the incision into the retroduodenal portion of the common duct was made unnecessary by the bimanual manipulations which brought the stone up so that it could be removed through the supraduodenal portion. In one of his later topics, entitled, " Die Resultate von 360 Gallenstein Laparotomieen unter besonderer Berücksichtigung der in den letzten zwei Jahren ausgeführten 151 Operationen" (*vide* above), he expresses himself thus: " Chiefly the stones impacted in the duodenum, or even in the papilla, are difficult to remove. A certain manipulation I have found very valuable: With the left hand in the abdomen, the left index-finger is introduced into the open coledochus fixed by sutures, while the right hand presses the abdominal wall against the left hand, thereby using bimanual influence on the stone, by which it may be loosened

and removed from the common duct. I can heartily recommend this manipulation. When the common duct is not large enough to admit of the introduction of the finger, transverse incision into the duodenum is indicated."

To what results these manipulations with the finger and instruments may sometimes lead in cases where the tissues are friable, I have already illustrated by the two cases mentioned by Mayo of Rochester. In my case I am of the opinion that all of these manipulations would have been futile, and much time would have been lost unnecessarily, as the impaction was so firm that, even after a large incision through the posterior wall of the duodenum, it was extremely difficult to dig it out of its diverticulum without rupturing adjacent tissues.

That in cases where the impaction of the stone is not near the papilla, or the papilla cannot be found immediately, incision through the posterior wall of the duodenum and to the impacted stones in the common duct is the proper method of operation, I have already touched upon in my introduction. It is advisable in such cases to suture that part of the common duct which has been incised to the duodenum (choledochoduodenostomia interna), as this will prevent infection of that place which is lying between the duct and the duodenum.

This is not the place to go into further details of the preparation of patients, jaundiced for a longer period of time, before operation. In all such cases it is advisable to administer, according to Robson, chloride of calcium with or without gelatin, of which the active agent has been shown to be the lime, to prevent hæmorrhage during and after the operation. For this same reason I did not extirpate the gall-bladder, but in my case resorted to drainage of the bladder after a method known as Poppert's [17] method, which, however, was already practised beforehand by Longyear and Hall, of Cincinnati, in 1893, according to Haggard.[18]

In closing, I may be allowed to draw the following conclusions:

First, the transduodenal route has a well-defined place in the surgery of obstruction of the common duct produced by gall-stones;

Second, lithotomia transduodenalis, first advocated and practised by McBurney in 1891, either after his methods, that is, with incision of the papilla, or Collins's method, that is, dilatation of the papilla, is the method *par excellence* for all cases of gall-stones impacted at or near the opening of the papilla, as soon as experiments of manipulation, to press the stone into the duodenum by bimanual manipulations, have proved unsuccessful;

Third, choledochotomia transduodenalis is indicated for stones impacted in the retroduodenal portion of the common duct, or before the diverticulum of Vater, as soon as efforts to dislodge the stone up into the supraduodenal portion have proved futile;

Fourth, in all cases where choledochotomia transduodenalis has been performed, it is advisable to suture the common duct to the duodenum to avoid infection (choledochoduodenostomia interna);

Fifth, choledochotomia transduodenalis seems to be more advisable than choledochotomia retroduodenalis because it can be more easily performed, and the integrity of the pancreas is not interfered with;

Sixth, it has not been proven by statistics that transduodenal choledochotomy has a greater percentage of fatalities produced by septic infection than supraduodenal choledochotomy. Further contributions in this direction are desirable for the purpose of procuring definite conclusions. Most of the cases where sepsis was the cause of the death of the patient after an operation on the common duct, were cases of infection of the bile passages before operation, and the method of operation was not responsible for the fatal result.

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STRANGULATION OF VERMIFORM APPENDIX IN RIGHT FEMORAL RING.

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Mrs. R., aged fifty-three years, sent for me on August 19, 1894, complaining of an intensely painful swelling in the right groin. For years she had been conscious of a small swelling about the size of a hazel-nut in the region of the right saphenous opening, which became larger if she strained at stool, and gradually went back again to its original size, but never entirely disappeared. About a fortnight before I saw her, constipation had been worse than usual, and suddenly the swelling increased to an elongated roll about one and a half inches in length. She became very faint with a great feeling of sickness, which passed off after a time; but the swelling remained enlarged, and was very painful. This state of affairs went on till August 17, when the lump became more painful and inflamed, and the patient became so ill that she had to go to bed; nausea and faintness now returned.

At my first visit the patient was lying on her back, with the right thigh a little flexed on the abdomen; aspect worn and pale, tongue very much furred, but moist; some nausea, no actual vomiting, pulse feeble and rapid, 120, and temperature, 100.5° F. On examining the right femoral region, an inflamed swelling, about one and a half inches long and one inch broad, was found, lying very much internal to the vessels on the adductor longus. The skin was closely adherent to the tumor at one place, and appeared to be thinned, œdematous, and almost as if an abscess were pointing there. There was some sense of fluctuation. On tracing the swelling up above Poupart's ligament, there was a sense of fulness, and very great pain and tenderness. There had been no absolute intestinal obstruction. The bowels acted last on August 16, and flatus had been passed per anus.

Notwithstanding absolute rest in bed, hot boracic fomenta-

tions to the swelling, and liquid diet, the symptoms became more severe, greater pain in the swelling, more nausea. On August 21 the bowels were opened, the distress and pain being very great before and after the action. The swelling became larger, the area of redness had extended, and the centre of the tumor was of a bluish color, with distinct fluctuation. August 22, the swelling was opened under cocaine. Temperature before operation, 102° F.; pulse, 130. Thick, grumous, very fœtid pus spurted out, followed by currant or raspberry seeds. On investigation, I found that this fruit was last partaken of six or eight weeks before the date of operation. The wound was dressed with hot boracic acid; a drainage tube was inserted. During the following days her general condition gradually improved; on the sixth day a sloughing mass which had presented in the abscess cavity was cut away, and after removal was recognized to be the vermiform appendix.

September 1. After straining a little at stool, no enæma having been used, some feculent discharge appeared in the wound (blackened by bismuth, which had been given for pyrosis), and, on pressure above Poupart's ligament, it was possible to press out the contents of the bowels through a pinhole opening. There was still some considerable tenderness in the groin above the ligament.

September 20. Patient well; no fæcal discharge from the wound, which is soundly healed. She can walk quite upright without pain, except on pressure; gaining flesh.

A CONTRIBUTION TO THE STUDY OF INTRA-ABDOMINAL OMENTAL TORSION.

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In the ANNALS OF SURGERY of November, 1900, Joseph Wiener, Jr., of New York, reports a case of omental torsion. In addition, he publishes a synopsis of five other cases, these being all the cases which he was able to find in the literature. These six cases may be briefly summarized as follows:

No. 1. Oberst, 1882. Male, aged thirty-five years. Right inguinal hernia of twelve years' standing. Omentum incarcerated in the sac. Torsion supposed to be due to forcible attempts at reduction.

No. 2. Bayer, 1898. Female, aged fifty-four years. Left inguinal hernia of fifteen years' standing. Omentum incarcerated with torsion and becoming gangrenous.

No. 3. Baracz, 1900. Male, aged forty-two years. Left inguinal hernia of several years' standing. Omentum adherent to bottom of sac, but a twisted and gangrenous portion, size of an ostrich egg, in abdominal cavity.

No. 4. Peck, 1900. Female, aged thirty-seven years. Right inguinal hernia of twelve years' standing. *Omentum not connected with hernial sac.* Entire omentum was found twisted around a vertical axis, occupying the right side of the abdomen, the lower end being in the pelvis.

No. 5. Hochenegg, 1900. Male, aged forty-one years. Right inguinal hernia of thirty years' standing. Large gangrenous omental mass found in right side of the abdomen; had occupied the hernial sac until a few hours before the operation, when it was forcibly reduced.

No. 6. Wiener, 1900. Male, aged seventy-nine years. Right inguinal hernia for thirty years. Strangulated piece of omentum found in right side of the abdomen, with twisted pedicle; *not connected with the hernia.*

Rokitansky was the first to thoroughly discuss the causes which he regarded as producing the twisting of the pedicle of ovarian tumors, with the symptomatology of which every sur-

geon is familiar. All that seems to be primarily essential is the existence of a pedunculated tumor with no mechanical obstacles to its rotation. If the pedicle is so situated as to furnish a perpendicular axis for rotation, torsion will be more apt to occur. If a perpendicular axis is afforded by the pedicle proper and also by an adhesion at the bottom, torsion will be still more apt to take place.

In five of the six cases above reported, there seems to be no question as to the causative connection between the omental mass and the hernia. Indeed, in the first case reported the torsion was not strictly abdominal at all, since the entire mass was incarcerated in the sac. The case, however, clearly belongs in this class, since its incarceration was simply incidental. In Wiener's case, the mass at the operation had no connection with the hernia and was high up; so he concludes that the existence of the hernia was merely incidental and had no etiological relationship. This, however, is questionable, since the formation of an omental pedunculated tumor might have taken place years before from the entrance of omentum into the hernia, but conditions favorable to the twisting had not previously taken place. It is possible, however, that, as believed by him, the hernia was simply incidental in his case. It is then probably necessary to believe that the existence of the pedicle was congenital and due to a malformation of the omentum. Some sort of a pedicle seems to be a prerequisite, and from the cases reported it is evident that this pedicle is usually formed by a portion of the omentum becoming involved in a hernia. That a congenital malformation may give such a pedicle is shown possibly by Wiener's case, and quite positively by my own. It is by no means necessary to the production of the torsion that the pedicle should be particularly small, as is shown by several of these cases; although, of course, the smaller the pedicle the more easily could rotation take place. The writer has had a case of hydrosalpinx with a twisted pedicle; here we not only had a very broad pedicle but also a short one; and yet in some way twisting had occurred, with the usual inflammatory symptoms necessitating operation.

The writer has had two cases of omental tumor belonging to this series, the first of which is reported merely as perhaps throwing light upon the formation of these masses. The second case is reported as showing that a hernia is not absolutely essential to the formation of these omental masses, since in that case no hernia had ever existed. In this respect, then, the case may be regarded as absolutely unique.

In the six cases reported by Wiener, the diagnosis in four was simply that of strangulated hernia. In one of the others the symptoms led to a diagnosis of appendicitis, and in his own to that of an intraperitoneal abscess. In my own case the diagnosis of a mild but progressive appendicitis seemed clearly warranted. In all the cases the gravity of the symptoms was recognized and prompt operation resorted to.

CASE I. *Distinct Pedicle, and Attachment to Hernial Sac.*—D. D. F., aged twenty-nine years. Referred by Dr. Stickney. One year ago, as result of heavy lifting, there formed an acute right inguinal hernia. Twenty minutes after the appearance of the tumor the pain became so severe as to compel him to go to bed. A large swelling formed, which later was lanced, and exit given to a large amount of pus. This abscess healed, but later a second abscess formed, which was treated in the same way. Healing then took place, but an irreducible mass still persisted and rendered him unable to work. I first saw him April 7, 1902, at which time an ill-defined mass could be felt in the right inguinal canal and extending down to the bottom of the scrotum. The diagnosis of omental hernia seemed clear. From the history of the two abscesses, I was inclined to suspect that the appendix might be involved. The usual hernia operation was advised and executed on the 8th. On opening the hernial sac, which extended to the testicle, a small piece of omentum was found occupying the sac, but adherent only at the bottom. This adhesion was separated, and on pulling down the omentum a mass soon appeared, which was drawn out with considerable difficulty. It proved to be an omental tumor five or six inches long and more than an inch in diameter, with a smooth exterior, and looking not much unlike a piece of bowel. On bringing it out, it was found connected to the rest of the omentum by quite a narrow pedicle. This pedicle

was ligated and the tumor removed, and the operation completed in the usual manner. On examining the specimen, it was found that after separating a few adhesions keeping it in shape, the mass could be spread out into quite a normal looking piece of omentum. From the history and appearance there could be no question that this mass had from time to time occupied the hernial sac, but that reduction, while complete so far as the mass was concerned, was incomplete, owing to the adhesion of the strip of omentum to the bottom of the sac. Here we had clearly conditions most favorable for torsion, but this had fortunately not taken place.

CASE II. *Intra-abdominal Omental Torsion, without Hernia.* —J. E. T., aged forty-seven years. Referred by Dr. Hecker, of New Madison, Ohio. Patient was a well developed male, a clerk in a country store, who had always enjoyed excellent health. On Friday, without any assignable cause, his stomach became somewhat disturbed. He did not vomit, but felt a little nausea. He had an uneasy sensation in the right side of the abdomen and suspected appendicitis. A doctor, to whom he incidentally mentioned his condition, advised him to take a dose of oil. This was taken and operated freely, but with no relief to his symptoms. Saturday morning he had a good deal of pain in the right side of the abdomen, together with tenderness, which led him to consult his regular physician, Dr. Hecker. At this time there was a good deal of abdominal rigidity on this side. His general condition seemed good. The symptoms were not sufficiently marked for a diagnosis, and the patient was therefore treated on general principles. Sunday morning he felt still worse, and sent for his physician. The pain in the right side was more pronounced. The tenderness and muscular rigidity were more marked. Early Monday morning, the symptoms persisting and becoming still more pronounced, a diagnosis of appendicitis was made by Dr. Hecker, and concurred in by Dr. Myers, who had been called in consultation. I was at once telephoned to, and reached the patient's bedside at 1.30 P.M. Patient's pulse and temperature were practically normal. He complained a good deal of pain, although he had been given two grains of opium. Abdominal tenderness and rigidity were both pronounced. When asked where he felt the most pain, he put his finger almost exactly on McBurney's point. The most tenderness, however, I found to be slightly above this point. Of the correctness of the diagnosis there seemed no rea-

sonable doubt, and, as the case was clearly progressing and the patient at a distance (over one hundred miles), an operation seemed clearly advisable and was at once executed.

Owing to the tenderness being higher up than usual, the incision was made above the usual location. The gridiron incision was used. On introducing the finger, a hard mass could be made out above the opening. This was slightly adherent to surrounding parts as a result of the existing local peritonitis. Examination led to an exclusion of malignancy and of any connection with the gall-bladder. Examination of the head of the colon, which was then made, showed this to be in its usual place and normal, with no recent trouble about the appendix. The adhesions above were therefore separated and the mass brought down and carefully drawn through the incision. As soon as it was exposed the diagnosis was at once plain. The mass proved to be made up of omentum rolled up so as to make a distinct tumor and having a very small pedicle, not larger than a knitting-needle, twisted upon itself eight times. The entire mass was about the size of a large fig. The pedicle was ligated and the tumor removed. The appendix was then more carefully examined and its distal portion found obliterated. The obliterated portion was cut off, the rest inverted by my usual method, and the incision closed in the usual way. Recovery was absolutely uneventful. Examination of the specimen showed it to be made up of ordinary omentum, but rolled together and adherent so as to make a distinct tumor. When the adhesions were separated it could be spread out, just about covering the palm of the hand.

PRIMARY TUBERCULOSIS OF THE PAROTID GLAND.[1]

By JACOB FRANK, M.D.,

OF CHICAGO,

SURGEON TO THE GERMAN AND CONSULTING SURGEON TO ST. ELIZABETH'S HOSPITALS.

After carefully perusing the literature, two facts stand out prominently, namely, that primary tuberculosis of the parotid gland is either of very rare occurrence, or remained unrecognized by clinicians, as up to the present time only eight cases of this affection have been recorded, and none of these cases were observed by English or American surgeons. Our most recent English text-books on surgery and surgical pathology do not mention anything about this disease.

We must acknowledge our indebtedness to the German, Italian, and French surgeons for their scientific reports of the pathology of primary tuberculosis of the parotid gland and the treatment thereof. To L. von Stubenrauch belongs the credit for reporting the first case of primary tuberculosis of the parotid. This appeared in the *Archiv für klinische Chirurgie* in 1894, Band xlvii, pp. 26-31. De Paoli, in the "Annal. del l'Academia Medica di Perugia in 1893," one year previously reported his first case, which later was found to be secondary to middle ear disease,—undoubtedly of tubercular origin; therefore this case cannot be classified among the primary lesions. Following von Stubenrauch's report, de Paoli, Legueu et Morieu, Backhorn, Meslay, P. Legene, and Küttner have each reported one case.

Considering the rarity of this disease and the failure of our English and American confrères to note its existence, I consider myself very fortunate in being able to add one more

[1] Read before the Chicago Surgical Society, June, 1902.

case to the literature, and to be the first American surgeon to recognize the existence of this seemingly rare affection.

The case was that of a male child about twenty-two months old, of healthy parentage, always in good health, who developed a swelling in the right parotid region. After some time, as the swelling persisted, the child was taken to a hospital, where an incision was made, with evacuation of some pus. Six weeks later, the opening not having closed, I was consulted. The child had a swelling in the right parotid region, more pronounced in front than behind, tense, shiny, of a bluish discoloration, and having at its centre a fistulous opening with a pronounced granular wall; from this opening a thick, cheesy material could be expressed, and on closer examination a flow of salivary secretion was detected.

The child was readmitted to the hospital, where an incision about two and one-half inches in length behind the ear in a downward direction was made. The broken-down tissue was first curetted, the wound thoroughly cleansed, then the rest of the diseased gland, including a goodly portion of the healthy tissue, was removed by careful dissection. The cavity was packed with strips of gauze and a dressing applied. The child remained in the hospital for five days. Only the outside dressing had to be changed daily for the first three days, as it was saturated with oozing and salivary fluids; after this, complete daily dressings were carried out until full recovery. An unavoidable temporary paralysis resulted on the same side of the face, which lasted for several weeks, gradually disappearing. It is now a little over two years since the operation; the child enjoys the best of health, and there is no evidence of any recurrence.

A microscopic examination of the removed glandular tissue established the positive character of the pathology of the gland, being histologically typical of tuberculosis of that organ.

In presenting this rare and interesting subject, after analyzing all recorded cases together with my own report, I shall take up separately the etiology, pathology, course, symptoms, diagnosis, prognosis, and treatment based upon a study of these cases.

(1) The etiology of primary tuberculosis of the parotid

gland may, like all causative factors, be divided into a predisposing or primary cause and a specific or secondary cause. The predisposing cause may be a slight injury. The specific or secondary cause is due to an infection by the Bacillus tuberculosis of Koch, which may, according to various writers on this subject, take place in different ways. L. von Stubenrauch is of the opinion that the infection takes place from the mouth through Steno's duct, as was demonstrated in his case where the duct was occluded and the gland converted into a cyst which proved to be tubercular. Backhorn, on the other hand, claims that it takes place through the lymph vessels from a wound in the mouth or carious teeth near the parotid; whilst de Paoli claims that it may also take place through the circulation, and he bases his opinion on some of his successful experiments on animals, where he succeeded in producing, after a method which he failed to describe, tuberculosis of the parotid gland. All opinions, however, are merely theoretical. Although von Stubenrauch's opinion seems to me to be more plausible as the route is more direct through Steno's duct, yet the other theories must not be rejected entirely, for we get primary tuberculosis of the knee-joint, a location which has no ducts. The disease occurs between the ages of two and sixty-one years, more frequently in adult life; both sexes are equally liable to this disease, and both sides are as frequently affected.

(2) The pathology: two forms are recognized by von Stubenrauch, de Paoli, and others,—a diffuse and circumscribed form. The diffuse form being the most common, consisting of small and large caseous areas or abscesses, the parotid tissue is œdematous, friable, and in places indurated. The circumscribed form is very rare; it may take the form of a cold abscess or the form of a cyst, as was demonstrated in von Stubenrauch's case. It is a purely local affection. In some cases the glandular tissue is the seat of pathological changes, and in others again the interstitial tissue. Histologically, all the elements of a tubercular process are found,—giant, epithelioid, and round cells; tubercles of Laennec, and in most of the cases tubercle bacilli, were demonstrated.

(3) The course of this disease, like all chronic infections, is very slow. In most of the cases the enlargement was noticed accidentally, and, on account of its slow growth, no further notice usually taken. Only in de Paoli's case facial paralysis was observed, after repeated attacks of facial neuralgia, long before a swelling appeared.

(4) The symptom found in most of the reported cases was swelling of the gland, either in the form of a circumscribed and fluctuating tumor or a more diffuse with occasional soft spots here and there, the skin being usually adherent, red, tense, shiny, and œdematous. As a rule, on pressure the size of the swelling does not diminish, with the exception of Küttner's case, where a communication existed between the abscess and the duct, and on pressure some of the pus escaped through the duct, diminishing thereby the size of the swelling. There was no enlargement of the glands of the neck in any of the cases. In most of the cases pain was present late in the disease.

(5) The diagnosis, on account of its rarity, the absence of the disease elsewhere, and also the absence of pathognomonic signs, is clinically very difficult. In all cases the diagnosis made before the operation was either syphilis, interstitial parotitis, or malignant growths; the diagnosis of the former was more frequently made. In all cases the microscope made the diagnosis after the operation. The examination of the secretion before the operation was overlooked in all cases, including my own; this should not be the case hereafter.

(6) The prognosis is very good, being a purely local affection; operative interference results in a permanent cure, as was seen in all cases, with the exception of de Paoli's case, which was already excluded from our list as not being a primary disease. In many cases temporary facial paralysis resulted, which in course of time disappeared. In de Paoli's case the paralysis was permanent, but not due to the operation.

(7) The treatment is operative. There is one fact we learn from the cases recorded, that the total extirpation of the gland is not essential to a permanent cure.

TABLE OF CASES OF TUBERCULOSIS OF PAROTID GLAND GATHERED FROM LITERATURE.

Bibliography.	No.	Sex.	Age.	Occupation.	Family History.	Side.	Course and Diagnosis.	Treatment and Result.	Histologically.
De Paoli, Annal. del l'Academia Medica di Perugia, 1893.	1	Could	not	find data.			Repeated attacks of facial neuralgia followed by facial paralysis; no diagnosis made.	Enucleation of diseased part of gland; recurrence on other side found to be secondary.	Tuberculosis demonstrated.
L. von Stubenrauch, Archiv für klinische Chirurgie, 1894, Vol. xlvii, pages 26–31.	2	Female.	60	Housewife.	Negative.	Right.	Stomatitis; profuse secretion of saliva for one year; cyst of parotid; diagnosis, mixed tumor.	Enucleation; complete recovery; temporary paralysis only.	Tuberculosis.
De Paoli, Comptes Rendus Soc. Ital. Chir., 1895.	3	Could	not	find data.			A diagnosis of syphilis.	Ligation of external carotid; complete enucleation; temporary paralysis; recovery.	Tuberculosis.
Legueu et Morieu, Semaine Méd., 1895, page 549.	4	Female.	3		Negative.	Right.	One-half year duration; pain few weeks before operation; swelling; diagnosis, sarcoma.	Operation; partial enucleation; recovery; temporary paralysis; no recurrence.	Tuberculosis.
Backhorn, Archiv für klinische Chirurgie, Band lvi, 1898, pages 189–201.	5	Female.	39	Housewife.	Negative.	Left.	Two carious teeth for past three months, and swelling of gland; treatment for six weeks; for past five days severe pain; syphilis.	Operation; partial enucleation; temporary paralysis; recovery; no recurrence.	Tuberculosis.
Meslay, Bul. Soc. Anat. de Paris, 1898, Vol. lxxiii, pages 710, 711.	6	Male.	61	Ex-soldier.	Negative.	Left.	Diagnosed as mixed tumor; swelling present for three months; latter part painful.	Operation; partial enucleation of parotid; temporary paralysis; recovery; no recurrence.	Tuberculosis.
Küttner, Handb. des pract. Chir. (Braun, Mikulicz, Bergman), 1900, Band i, page 714.	7	Male.	18		Negative.	Left.	One-half year standing swelling, fluctuating; pus discharge through duct; no diagnosis.	Operation; two sittings; enucleation of pus; two partial enucleations; recovery; temporary paralysis; no recurrence.	Tuberculosis.
Legene, Rev. de Chir., 1901, Vol. xxiii, pages 524–531.	8	Male.	29	Newsboy.	Negative.	Left.	Swelling ten years' standing; no pain until before operation; diagnosis, mixed tumor; syphilis.	Partial enucleation; temporary paralysis; recovery; no recurrence.	Tuberculosis.

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De Paoli: Annal. del l'Academia Medica di Perugia, 1893.
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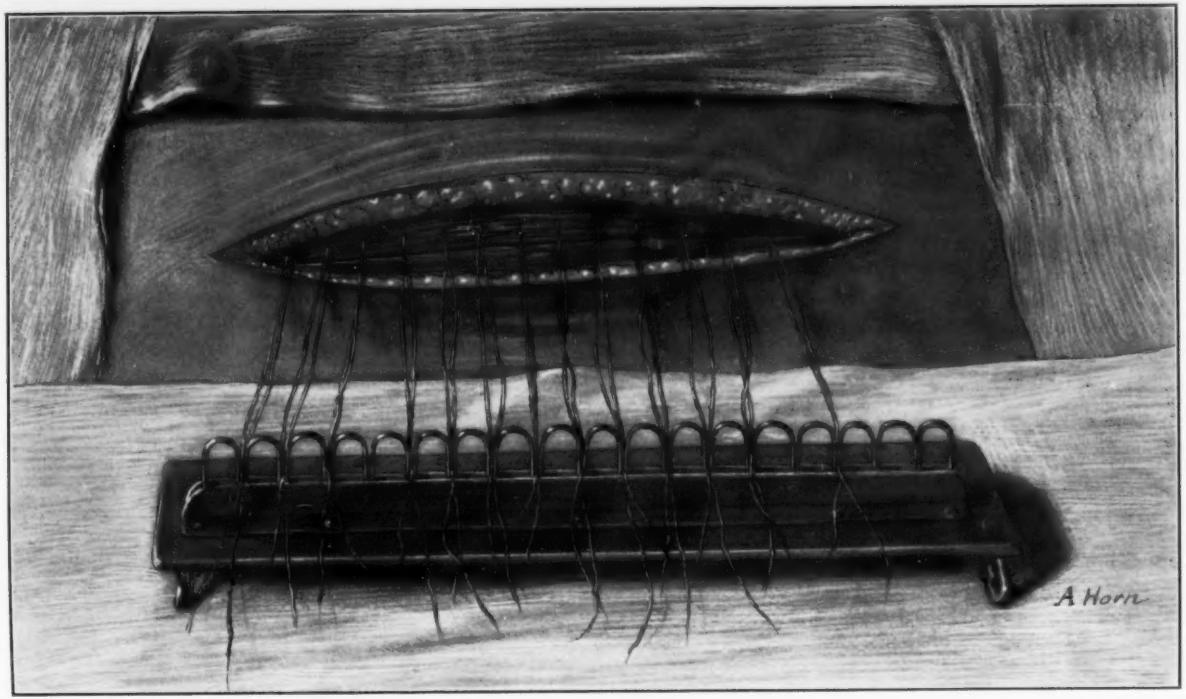
Legueu et Morieu: Semaine Médicale, 1895, page 549.
Backhorn: Archiv für klinische Chirurgie, Vol. lvi, 1898, pages 189–201.
Meslay: Bull. Soc. Anat. de Paris, 1898, Vol. lxxiii, pages 710–716.
P. Legene: Revue de Chirurgie, 1901, Vol. xxiii, pages 524–531.
Küttner: Archiv für klinische Chirurgie, Band lvii, 1898, Heft 4.
Parent: Thèse de Paris, 1898.



Ligature segregator.

A SIMPLE DEVICE FOR HOLDING LIGATURES.

By MAURICE RUBEL, M.D.,

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It must have occurred to every one doing surgical work that the ordinary method of keeping the ends of ligatures separated with artery clamps is anything but ideal. I refer especially to the closure of abdominal incisions with interrupted stitches.

In bringing the edges of the wound together with interrupted stitches, it is often customary to place the ligatures one after another, an assistant clamping the two ends of each ligature together with a pair of artery forceps. After all the sutures are set, the clamps must be removed one at a time, so that the ligatures can be tied. The operator may now see fit to cut away the superfluous amount of suture material, or he may prefer to have it again clamped so that all the sutures may be cut at the same time after they are all tied.

If the incision be a long one, many clamps are required, and they are very likely to become entangled, so that much time is lost in separating them. Furthermore, it consumes some little time to open and close the clamp for each ligature separately.

The simple instrument which is here pictured has, I believe, several advantages. It keeps the ends of each ligature together, and yet separate from the other sutures; it retains the sutures in their proper order, so that after they are set in the tissues and placed in the segregator (as the instrument might well be called) they can be picked up in order one at a time, tied, and the ends placed back again in the instrument. This does away with the use of many clamps, which are always getting in the way; it enables one to pick up and tie any one of the ligatures at any time, a thing which cannot be done without delay when clamps are used, as they are very likely to become entangled; and lastly, if

necessary, the assistant can be dispensed with during the entire closure of the wound.

The device, as can readily be seen, consists of a flat steel bar on which a tempered wire bent to form a row of V-shaped grooves about one-half an inch apart has been soldered. At either end of the bar there is a safety-pin to fasten the instrument to the dressings. The segregator is pinned to the dressings about ten centimetres from the wound and parallel to it. It is, of course, made entirely of steel, so that it can be sterilized without being injured.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, October 8, 1902.

The President, LUCIUS W. HOTCHKISS, M.D., in the Chair.

GASTROJEJUNOSTOMY FOR CARCINOMA OF PYLORUS.

DR. F. TILDEN BROWN presented a man, aged thirty-four years, who was admitted to the Presbyterian Hospital on July 9 of the present year. His father and one paternal uncle died of cancer of the stomach; his sister and one paternal aunt died of cancer of the uterus.

The patient gave no alcoholic history, but he was always a hasty and irregular eater. Fifteen years ago he suffered from insolation, with delirium for two months. He made a complete recovery, and has always been strong and well with the exception of occasional attacks of indigestion. About a year ago he began to have a burning pain in the epigastrium two or three hours after eating. This pain was relieved by vomiting, which was artificially produced. He was also troubled with flatulence, and for one month after the onset of his illness he suffered from severe diarrhœa. These symptoms have persisted, with varying intensity, up to the present time. His appetite is very poor, and he has lost about twenty pounds in weight during the past year. The epigastric pain is not constant; there is no tenderness nor jaundice. For the past three or four months his feet and legs have become swollen on standing, and at times his face and eyelids are puffy in the morning. There is slight dyspnœa and cough.

From July 9 until the 24th the patient was kept under observation on the medical side of the hospital. A physical examination was practically normal. The stomach, when dilated with water, percussed to two inches below the umbilicus. Lavage gave no

relief to the symptoms. An examination of the blood shows red blood-corpuscles, 4,660,000; hæmoglobin, 75 per cent.; leucocytes, 7650. An analysis of the stomach contents was acid to litmus, and gave a free hydrochloric acid reaction of .0438 per cent.; total acidity, .233 per cent.; no lactic acid, no butyric acid. The liver percussion extended from the fifth to the ninth intercostal space; its free edge could not be felt. The abdomen was very much retracted, with moderately lax walls. No tenderness could be elicited on pressure and no masses could be felt.

A diagnosis of pyloric obstruction was made, probably benign in character. On July 24 a five-inch median incision was made between the umbilicus and the ensiform cartilage. The stomach was found to be greatly dilated. Surrounding the pyloric extremity and extending along the lesser curvature of the stomach was an irregular, hard mass, about the size of an average adult fist, and evidently carcinomatous. Numerous enlarged lymph glands were felt in different directions. The anticipated pyloroplasty for stenosis was supplanted by a gastrojejunostomy. Parts of the omentum, transverse colon, and greater curvature of the stomach were wrapped in hot towels at the upper end of the wound; the jejunum, identified by Treitz's ligament, was then drawn out and its proximal and distal parts marked by a white and black silk suture; the transverse mesocolon was pierced and the posterior wall of the stomach drawn through. The adjacent serous surfaces of the stomach and jejunum were then united by silk Lembert sutures; one-quarter of an inch in front of this line a two-inch one-half incision was made in each viscus; these were treated with interrupted silk sutures, and the anterior surfaces of the apertures managed in the same way.

The patient rallied well after the operation. He was fed at the beginning of the third day without causing nausea or vomiting, and began to pick up rapidly in weight; so much so that his gain was very striking day by day. He left the hospital on August 21, and his weight has increased from 95 to 145 pounds. There is now a mass in the epigastrium which is easily palpable.

GASTROSTOMY.

Dr. W. G. Le Boutillier presented a man, forty-eight years old, who, five months previous to his admission to hospital, had swallowed a fish-bone, which caused some pain in his neck and

the expectoration of a little blood. Six weeks later he began to have some difficulty in swallowing solid food; this dysphagia rapidly increased, and when he came to the hospital the obstruction of the œsophagus was almost complete. No instrument could be passed beyond an obstruction located seven and one-half inches below the line of the teeth, and fluids could be swallowed only very slowly. A few days before his admission to the hospital he had developed a laryngitis, which still persists. This gave rise to the suspicion of aneurism, but an examination of the throat showed a simple laryngitis.

A gastrostomy was done by Dr. Le Boutillier, following the Kader method, on August 25, 1902, and the man has since been fed through the stomach. He has gained about fifteen pounds in weight. There is practically no leakage from the artificial opening, and hence no irritation of the skin.

Two years ago, the speaker said, this same patient was operated on by him for an inguinal hernia by the Bassini method. He resumed his occupation as a nurse some four weeks after the operation, has worn no truss or external support, and there are no indications of a recurrence.

RESECTION OF FIVE FEET OF SMALL INTESTINE FOR MALIGNANT DISEASE.

Dr. B. Farquhar Curtis presented a man thirty-three years of age. He had been ailing for some months before he came under Dr. Curtis's observation. At that time he already showed signs of emaciation, and was suffering from intense pain, which spread over the entire abdomen, but seemed to be most severe in the neighborhood of the appendix. He had an easily palpable mass in that situation, and another, which was less distinct, up towards the umbilicus. There were no stomach symptoms, no constipation, no history of passing pus or blood per rectum. While the diagnosis was uncertain, it seemed probable that the case was one of malignant growth involving the intestine.

The man was operated on by Dr. Curtis at the General Memorial Hospital on May 13 last. He made a split-muscle incision in the region of the appendix, and found a mass of large size, which was evidently connected with the small intestines. It was freely movable, and, in order to explore it thoroughly, a

median incision was made higher up. He then found that six inches of what seemed to be the jejunum were involved in this growth, which measured over three inches in diameter. All the coats of the bowel were invaded. The bowel was enlarged in its external diameter, the walls much thickened; but the lumen was reduced very slightly, ulceration internally having kept pace with the growth of the tumor. In the adjoining mesentery were a few enlarged glands, and also towards the root of the mesentery. After isolating the mass and enucleating the involved glands in the mesentery, it was seen that the blood-supply of six feet of the small intestine had been cut off. This portion of the gut was therefore removed, and the divided ends united with a Murphy button, which the patient passed on the sixth day. He was discharged from the hospital about a month after the operation, and during the two subsequent months his condition was very good. He gained in weight, and his bowels moved twice daily, the passages being normal, in spite of the large segment of gut removed. Since August he is again beginning to lose ground. He is now somewhat anæmic, and has lost his appetite. The former pain has not returned, but he suffers somewhat from pain in the back.

The length of intestine removed measured, while in a fresh state and still attached to the mesentery, a little over sixty inches. The pathologist reported that it measured seventy-two inches, but this was after its separation from the mesentery. This places the case among those of extensive removal of the intestine, and the good condition of the patient is of interest in that connection. The pathologists reported that the growth was a carcinoma.

Dr. Curtis said that at the time of operating on this patient he noticed a small nodule on the neck, behind the clavicle. Since then this mass has continued to grow, and it is now of considerable size. While this tumor in the neck may be a mere coincidence, the speaker said he was inclined to believe it was connected with the thoracic duct. On account of its situation, he did not think it wise to attempt its removal by surgical intervention. The X-rays are being applied to it, as well as to the abdomen, where there are some vague signs of recurrence.

Dr. Lilienthal said he did not think there was anything surprising in the fact that Dr. Curtis's patient had only two daily movements of the bowels, and that they were normal in character,

in spite of the loss of such a large segment of the small intestine. The speaker referred to a case which he presented about eighteen months ago in which a few inches of the ileum and the entire colon —ascending, transverse, and descending—were removed, and in spite of this the patient had only two movements of the bowels daily. Immediately after the operation she suffered for a time from frequent, loose passages, but they finally became solid and the number decreased to two daily. This has continued up to the present time, and when he last heard from the patient, a few days ago, she was apparently enjoying excellent health. Dr. Lilienthal said that if this is so after removal of the entire colon, one would not expect diarrhœa after the loss of even five feet of small intestine.

INTRACRANIAL NEURECTOMY FOR TIC DOULOUREUX.

Dr. Robert Abbe read a paper with the above title, for which see the Annals of Surgery for January, 1903.

Dr. John F. Erdmann said that in the latter part of September he operated upon a woman who had long suffered from tic douloureux. He had proposed for over a year the removal of the Gasserian ganglion, but the patient refused to submit to it, on the ground that it would necessitate the loss of her hair; and he thereupon resorted to the operation of Jonnesco in July of this year, which was suggested by an Italian surgeon, G. Carazzani, for the relief of these cases, namely, removal of the superior sympathetic ganglion. This operation did not give her immediate relief, but her attacks of pain gradually became less frequent and less intense. This improvement was only temporary, however, and at the end of a month her former attacks returned with increased severity, so that two weeks ago she consented to removal of the Gasserian ganglion, and this was done.

Dr. Erdmann said that in two other cases where he had operated, he removed the second and third branches of the nerve and the ganglion of Gasser according to the classical description by Hartley. As to the possibility of injuring the brain substance by too strong retraction of the parts, he said that in his last case the retractor was turned over to an assistant, who probably exercised a little too much force, and, as a result of the pressure upon

the brain, the patient remained totally unconscious for nine days subsequent to the operation. She is now completely recovered and absolutely relieved.

Dr. Curtis referred to the possibility of obstinate hæmorrhage as a complication in this operation. About a year ago last June he operated on a young man; and when he had partially completed the bone-flap, the bleeding, which had been quite profuse from the beginning, became so severe and uncontrollable that he packed the wound and temporarily abandoned the operation. Two or three days later he reopened the wound, but was again obliged to desist on account of the profuse hæmorrhage. A few days later, during Dr. Curtis's absence from the city, Dr. Stewart again reopened the wound and met with the same condition of affairs. The hæmorrhage was still so severe that nothing could be done, and he thereupon closed the wound permanently. During the patient's subsequent stay in the hospital he had no attacks of pain, having apparently been benefited by the incomplete operation. The man was not a "bleeder"; at least, there was no previous history of it, and the blood formed clots well.

Dr. Willy Meyer said he had done the operation of removal of the Gasserian ganglion a few times. In his first case he used the chisel, but he now employs the Gigli saw for the purpose of cutting through the bones, and by this method much valuable time is saved. In one instance he accidentally tore the meningeal artery when just ready to tie it, resulting in a very annoying hæmorrhage; but it was comparatively easy to check this by compressing the artery in the foramen and then resort to torsion. In none of his cases, Dr. Meyer said, was he obliged to desist on account of the bleeding, although he could readily imagine such an instance. Krause has stated that when the hæmorrhage is very severe, he would resort to pressure for a period of even half an hour, if necessary, in order to complete the operation in one sitting, for aseptic reasons.

Dr. Abbe has apparently demonstrated by his cases that the Gasserian ganglion need not be entirely removed, although in the literature on this subject the importance of such removal is emphasized. The intervention of the rubber tissue seems to prevent a reunion of the central and peripheric portion of the nerve.

Dr. Meyer said that in one of his earlier cases his assistant

pulled too strongly on the retracting hook. This, apparently, produced no immediate injurious effect, as the patient made a perfect recovery. A number of weeks later, however, he suddenly developed a high temperature without any assignable cause. It was first thought to be due to malaria, but he died suddenly, and an autopsy disclosed an abscess of the temporal lobe. This was probably the result of direct injury to the brain due to pressure, although the fact should be mentioned that catgut was used in closing the wound, and two small stitch abscesses had developed. Dr. Meyer said he now uses silkworm gut for suturing the skin in these cases, never catgut.

Dr. Abbe, in closing, said he looked upon rubber tissue as a valuable adjunct to surgical work. Among other things, he uses it in the treatment of ulcers, which rapidly cicatrize under a cover of rubber tissue. In the cases described in his paper, the rubber tissue covering the foramen apparently holds the nerve-cell proliferation in check until the proliferating process in the nerve stumps ceases.

In regard to the possibility of injuring the brain tissue by pressure, Dr. Abbe said that in order to avoid this he now holds the retractor himself, at the same time doing the dissection, and in this way he exerts just enough traction to give him the necessary room. The brain is elevated very gently, and with a small, blunt steel dissector the necessary work is done about the roots of the nerve.

In reply to a question, Dr. Abbe said he never intentionally opened the dura in operating on these cases.

INDEX TO SURGICAL PROGRESS.

HEAD AND NECK.

I. Aneurism of the Innominate Artery. By DR. H. JACOBSTHAL. The author reports a case of Braun's in the Königsberg clinic where the right subclavian and carotid arteries were ligated for innominate aneurism. There was no improvement, and the patient (aged forty-two years) died in fifty-one days post-operative. In his critical review of the subject, Jacobsthal presents (1) Poivet's table (1893) of ninety-four cases; (2) a list of twenty-eight cases published since then; (3) a list of thirty-three cases published since 1890, in which the treatment consisted of iodide of potash, Macewen's needling, filipuncture or subcutaneous injection of gelatin.

The results recorded do not support ligation. It is very doubtful if the peripheral ligation shows the blood stream or lowers pressure in the sac; the operation is more likely to increase the pressure. The immediate mortality is not trifling, viz., 55.7 per cent. In Poivet's list the "cures" are noted as 7.4 per cent.; in the author's there were none. In twenty-three cases the author found improvement thirteen times (56.5 per cent.), but no case was under observation longer than one year. Treatment other than ligation can well bear comparison with the above. Out of the thirty-three cases reported, one (filipuncture and electrolysis) lived three and one-half years, died of cerebral softening, and the autopsy showed that the aneurism was completely thrombosed. Fifteen cases were reported improved.—*Centralblatt für Chirurgie*, August 23, 1902.

ABDOMEN.

I. Clinical and Experimental Study of Peritoneal Adhesions occurring after Laparotomy. By DR. K. VOGEL. The clinical portion of this study is based on five cases from Schede's clinic in Bonn. In each case peritoneal adhesions were separated by operation but recurred, caused ileus, and in all but one patient, death. The essential lesion was an aseptic, recurrent, adhesive peritonitis. In Case 1 the exciting cause was intra-abdominal hæmorrhage from a contusion; in Cases 2 and 3 the excitants were an artificial anus and the extirpation of a tumor; in Case 4, intestinal ulceration, and in Case 5 a nephrorrhaphy, where an iodoform gauze tampon was used in the after-treatment (chemical irritation acting transperitoneally?). The last patient recovered after operation and the early postoperative use of aloes, and later of electricity, abdominal massage, and gymnastics.

The author made many experiments on animals in studying the etiology of adhesive peritonitis.

Apart from the natural tendency of the peritoneum to form adhesions, the author lists the following as causes: (1) Hæmorrhage, from intraperitoneal wounds, in so far as the injury hinders absorption, causes clotting, and by means of the clots occasions broader adhesions than could arise from the injury *per se;* (2) mechanical irritation and injury; (3) sloughs which are insufficient to hinder primary union; (4) chemical irritants insufficient to hinder union; (5) foreign bodies; (6) infection. Quietude of the intestine markedly favors the formation of adhesions.

In prophylaxis the author recommends, of course, aseptic instead of antiseptic technique; avoidance of unnecessary injury to the peritoneum, especially such as is caused by the use of sharp hooks (volsellum, etc.); avoidance of the cautery; careful suturing; wire is better than silk.

How to avoid recurrence after separation of adhesions by operation has been studied by the author in another series of experiments. While other experimenters have used salt solution

(Müller), the application of collodion to the ligature stumps (Stern), paraffin or tallow or gold-beater's skin, the author has tried decoction of salep, egg albumen, and a thick solution of gum Arabic thrown into the belly to act as a lubricant between the viscera.

The gum Arabic solution acted well. (Gum Arabic, 1; normal salt solution, 2, filtered and sterilized.) It was applied as follows: After almost complete closure of the wound, a drainage tube was passed into the belly, through this the solution was injected, the tube removed, and the suture completed.

To regulate peristalsis, subcutaneous injections of atropin and still better of salicylate of physostigmin were used. In one case after appendicectomy the latter drug was used in 0.0004 doses, from two to four times daily with good effect.—*Deutsche Zeitschrift für Chirurgie,* Band lxiii, 296.

II. Talma's Operation. By Dr. Bunge (Königsberg). On an experience of eight cases in the Königsberg clinic and a review of those published, Bunge discusses the results of and indications for the operation independently proposed by Talma and Drummond. The operation aims to provide collateral circulation in portal obstruction, by fixing the omentum to the abdominal wall, sometimes also by fixing the spleen, liver, or gall-bladder as well. The omental fixation may be intra- or extraperitoneal. Ito and Orni consider it best to produce extensive adhesions of the intestines to each other and to the belly wall.

The eight cases operated on in Königsberg were as follows:

(1) Syphilitic cirrhosis liver with great ascites. Omental fixation without benefit. Fixation of spleen caused gradual disappearance of the ascites

(2) Atrophic cirrhosis with great ascites. Omental fixation without benefit. Peritonitis developed, for which posterior colpotomy was performed to give drainage.

(3) Typical alcoholic cirrhosis with marked ascites. Omental fixation with brilliant result.

(4) Atrophic cirrhosis with great ascites. Omental fixation with negative result. Death in two months.

(5) Cirrhosis with severe gastric and intestinal hæmorrhage and slight ascites. Omental fixation with cessation of hæmorrhage and ascites.

(6) Cirrhosis of apparently cardiac origin. Omental fixation with improvement to the extent that the ascitic fluid did not require such frequent removal by puncture.

(7) Atrophic cirrhosis with great ascites. Omental fixation. Same result as in 6.

(8) Atrophic cirrhosis with moderate ascites. Omental fixation. Disappearance of ascites.

From literature the author was able to gather reports of ninety cases of Talma's operation, of which number only seventy-nine are suitable for statistics. Among these there are reported thirty-two recoveries, fifteen improvements, and thirty-two bad results.

The indications for operation are those diseases which lead to portal obstruction.

(1) Thrombosis of the portal vein or constriction by inflammatory products or tumors.

(2) Atrophic cirrhosis.

(3) Cardiac cirrhosis.

(4) Pericarditic pseudohepatic cirrhosis (Pick).

(5) Possibly Zuckergussleber.

The dangers of the operation are

(1) The danger of intestinal obstruction due to the omental fixation. This appears to be very slight.

(2) The danger of hernia when the fixation is extraperitoneal.

(3) The short circuiting of the liver. A number of patients presented symptoms which disappeared under a carbohydrate diet. The question of diet deserves study.

Contraindications.—Great disturbances of hepatic function, especially icterus, acholia, and hypocholia of the fæces, as well as grave cardiac and renal complications.

Conclusions.—(1) In cases of portal obstruction, Talma's operation has given about 40 per cent. of symptomatic cures.

(2) The chief benefit derived from the operation is the removal of the ascites, but gastro-intestinal hæmorrhage of portal origin constitutes an indication for the operation.

(3) The operation of choice is omental fixation, yet splenofixation has its use.

(4) Grave liver disturbance is a contraindication. Diminution of the excretion of urea, and alimentary glycosuria or Lävulosuria cannot be considered contraindications.

(5) When delirium develops or other symptoms of the liver being markedly shut out from the circulation, the diet must be regulated.—*Verhandlungen der deutschen Gesellschaft für Chirurgie*, 1902; *Centralblatt für Chirurgie*, 1902, No. 26.

III. Diversion of the Portal Circulation by Direct Union of the Venæ Portæ with the Vena Cava. By Professor Iginio Tansini (Palermo). Finding much opposition to the Talma operation, which is both very indirect and incomplete, the author and his assistants have endeavored to unite the portal vein directly to the inferior vena cava. The method adopted was the following: Expose and isolate the venæ portæ and a small portion of the vena cava. Apply two forceps with rubber-covered blades to control the blood in the vena cava; similarly apply one forceps to the portal vein. Ligate the venæ portæ at the hilus of the liver and divide it. Make an incision in, or, better, clip a spindle-shaped portion out of, the wall of the vena cava between the forceps. Place the open end of the venæ portæ into this opening and unite the wound margins with a continuous silk suture. It is not necessary to avoid penetrating the lumen If one now removes the clamps, one notes the blood flow from the portal vein into the vena cava, and the normal

color reappear in the intestines which had been rendered blue by the temporary interruption of circulation. The animals operated upon were plentifully fed with bones, etc. They were kept under observation for months, and had become fat before they were killed. (Seventy per cent. of the cases lived.)—*Centralblatt für Chirurgie*, 1902, No. 36.

JOHN F. BINNIE (Kansas City).

IV. Subcutaneous Rupture of the Intestine after Contusion of the Abdomen. By A. NEUMANN (Berlin). The author reports a case which recovered after laparotomy for a perforation of the duodenum, and in addition reviews all of the cases of such injury occurring during the past twenty years in the service of Hahn at Friedrichshain. The case upon which he operated was that of a man who had fallen fifteen feet, his abdomen striking upon the edge of a barrel. The laparotomy was performed six hours after the injury, and a perforation of the duodenum, with incipient peritonitis, found. The perforation in the duodenum was sutured. Recovery took place after severe symptoms of peritonitis had been present. Of 133 cases of contusion of the abdomen admitted to Friedrichshain during the past twenty years, sixty-one were complicated by serious visceral injuries. The intestine was most frequently involved (twenty-one cases); the kidney next (sixteen). The manner in which the force acts is either over a circumscribed area or in a diffuse manner. The former showed in sixty-eight cases, seventeen, or 26 per cent., ruptures of the intestine. In the latter variety, where the force acts over a wider area, there were only four ruptures of the intestine, or 7 per cent. Such a force is more likely to injure the solid viscera. He explains these variations by the theory that when a person is run over, falls from a height, or is crushed, that the intervals between the application of the force and the impact are sufficient to permit of reflex contraction of the abdominal muscles. It is also true that the crest and spine of the ilium serve to break the force of the fall or crush.

In horse-kicks or falls upon an object, the action is so rapid, however, that no protection can be given by the abdominal muscles. Most frequently the intestine is either crushed (resulting in immediate or later perforation) or it is torn from its mesentery, or at some fixed point like the duodenojejunal flexure. Bursting is quite rare, only once in twenty-two cases. The intestine is usually caught between the vertebral column and the force. There are no pathognomonic symptoms. Shock may come on immediately and be very severe, and yet there may be only a simple contusion without visceral injury. On the other hand, serious cases may present slight, if any, symptoms of shock. One of the most characteristic symptoms is the board-like rigidity of the abdominal muscles. Symptoms of peritonitis appear quite early; hence if one wishes to improve the present high mortality rate in these cases, they should be operated upon as early as possible. Of the twenty-two cases reported, many died without operation; others did not survive the operation more than an hour. In a large number the patient either did not give his consent until too late or did not enter the hospital until after the second or third day. Only the one case which Neumann operated upon survived. This, he states, is the general experience in large hospitals, and can only be improved by earlier recognition of the condition.—*Deutsche Zeitschrift für Chirurgie,* Band lxiv, No. 7.

V. Hæmatemesis in Appendicitis. By Dr. E. Nitzsche. When hæmatemesis occurs, one is apt to think of ulcer or carcinoma of the stomach, or of œsophageal varices from hepatic cirrhosis. We are now becoming acquainted with a larger class of cases of more diffuse etiology.

Rodman has called attention to its being a form of vicarious menstruation. Others have reported its frequent occurrence as a complication of laparotomy, especially after operations upon the omentum and bile passages. It can be best explained as being of embolic origin. Dieulafoy has reported cases of severe hæmate-

mesis following appendicitis. He believes in the absence of any macroscopic changes in the gastric mucosa that peritonitis was the cause.

The author reports a case occurring in a man sixty-two years of age who had a typical attack of appendicitis. Upon the second day he vomited a large quantity of coffee-ground material which gave the chemical reactions of blood. The patient died upon the fourth day of the disease. The autopsy showed a gangrenous appendix lying in a not well walled off intraperitoneal abscess cavity. The veins in the mesentery and omentum were not thrombosed. The jejunum and stomach were filled with a blackish fluid. In the mucous membrane of the fundus and greater curvature there were innumerable flat pinhead-sized ulcers covered in part by blood-clots. There were evidences of a diffuse septic peritonitis.

In view of the fact that the autopsy was performed three hours after death, the gastric ulcerations could not be considered as due to post-mortem digestion. Microscopically, the ulcerations were seen to involve the mucosa and submucosa. In one vein of the submucosa a fresh thrombus was found. There were also many areas of necrosis near the open ends of the glands, and at these points ulcers had formed.

Hæmorrhage takes place from these many small ulcers, and the cause of the latter is undoubtedly a toxic one. The glands of the stomach take up the poison, and in excreting it become necrotic and ulcers form. The toxins reach the stomach from the septic peritonitis either through the general circulation or in a retrograde manner through the veins, especially of the omentum.—*Deutsche Zeitschrift für Chirurgie,* Band lxiv.

DANIEL N. EISENDRATH (Chicago).

GENITO-URINARY ORGANS.

I. Injuries of the Kidney. By DR. WALDVOGEL. The author has collected twenty-three cases occurring between 1895

and 1900 in the Charité Clinic of Professor König. In eleven cases a fall was the cause of injury. In seven the patients had been run over. He thinks that the theory of Küster, of hydraulic pressure action of the fluids within the kidney upon its parenchyma, will not hold for all cases. In many the tear is the result of the force crushing the kidney directly either from in front or from behind. Sudden violent muscular contractions are also a factor.

Hæmaturia is the most reliable symptom. It may only be present in the form of a few red cells. Albuminuria may appear without blood from a trace upward. Casts may also be present with or without blood. The blood may be carried off through the ureters, collect around the organ (perirenal hæmatoma), or escape through a tear into the general peritoneal cavity. Perirenal collections occurred in about half of the cases. In three there was accompanying intraperitoneal hæmorrhage. In one it occurred as the latter alone.

Three of the twenty-three cases, or 13 per cent., died. They were operated upon during collapse. One had intraperitoneal hæmorrhage, a second also had a rupture of the liver. He advises conservative treatment in all cases. The extreme anæmia present in some may be due to injuries of other viscera, hence laparotomy with König's incision is advised. This permits exploration of the abdomen and, if necessary, tamponade of the kidney. The latter can often replace nephrectomy. Gunshot wounds should be treated in the same manner.—*Deutsche Zeitschrift für Chirurgie,* Band lxiv.

DANIEL N. EISENDRATH (Chicago).

II. Kryoscopy in the Diagnosis of Nephritis and the Prognosis of Nephrectomy. By DR. H. KÜMMELL (Hamburg). In 265 cases where the freezing point of the blood was established, the renal function was normal 137 times. The normal freezing

point of the blood (δ) is 0.56. Variations between 0.57 and 0.54 are physiological.

In the 137 cases of normal renal function, the blood freezing point (the sign of this is δ) was fifteen times 0.57, eleven times 0.55, and twice 0.54. The examinations were made on patients suffering from cystitis, pyelitis, very varied surgical diseases, and fevers, such as typhoid.

In fifty-one cases of unilateral renal disease, δ was once 0.56, three times 0.57, twice 0.55.

In seventy-seven cases of renal insufficiency, δ was varied from 0.58 to 0.81. The majority of the cases showed $\delta = 0.60$.

These figures establish the kryoscopic indications for and against nephrectomy. When δ is 0.58 or 0.59, renal sufficiency is incomplete, but yet nephrectomy may be performed without too great danger. The one kidney, while not entirely healthy, is yet capable of performing the duties of its excised fellow. When δ is more than 0.59, nephrectomy is contraindicated.

In 170 operations on the kidneys and ureters, δ was established prior to operation fifty times. In all these cases the correctness of the kryoscopic data was established by the results of the operations, or in a few cases by the abduction. (Of course, in all these cases the urine from each separate kidney was thoroughly examined.) Although we can by finding δ (*i.e.*, the freezing point of the blood) establish the presence of a kidney capable of sufficient function, yet this does not tell us which kidney is healthy, or if both kidneys are partially diseased. For this purpose, ureter catheterization and examination of the separate urines, chemically and thermometrically, is necessary.

Analysis of the fifty cases in which the freezing point of the blood (δ) was established before operation—six cases of hydronephrosis—all recovered. $\delta = 0.56$ in one case and 0.57 in five cases.

In one case $\delta = 0.60$; nephrotomy was performed. The freezing point afterwards became 0.58 and the diseased organ was removed. Recovery.

Fifteen cases of pyonephrosis. In ten, $\delta = 0.56 - 0.57$; in two, $\delta = 0.58$; in one, $\delta = 0.59$; in three, $\delta = 0.60 - 0.65$.

Of these cases thirteen recovered and two died, one from pulmonary embolism, the other from progressive renal suppuration —perforation of diaphragm, empyema, and pulmonary œdema; post-mortem examination showed that the other kidney, from which the urine had given $\delta = 0.56$, was healthy and compensatorily hypertrophied.

In a patient whose δ was 0.59, convalescence was disturbed by insufficient excretion of urine, albuminuria, and collapse. There was slow but complete recovery.

Of the three patients whose δ was 0.60 and lower, in two the kidney was split open and pus evacuated; δ rose to normal, and they recovered.

Among thirteen cases of renal calculus, two were double and had complete anuria; both recovered. One with double closure of the ureters, already gravely uræmic when seen, died. In the former two cases δ was 0.63 and 0.65 before operation, and became normal after. In one case of nephritis and calculus combined $\delta = 0.60$. After removal of the stone, the albumen lessened and δ became normal. In the remaining ten cases δ was 0.56 nine times and once 0.58.

Fourteen cases of renal tuberculosis. In eleven, $\delta = 0.56$—0.57; in one, $\delta = 0.54$; in one, $\delta = 0.55$; in one, $\delta = 0.60$.

In the last case there was disease of both kidneys, which were incised, pus evacuated. The patient died eight weeks later. In the other thirteen cases the disease was one-sided, the affected organ was removed, and recovery ensued.

In two cases of renal tuberculosis, δ was 0.63 and 0.64. The disease was bilateral, and operation was refused because of renal insufficiency.

The correctness of this determination was proved post-mortem.

The importance of determining the freezing point of the

blood and of the segregated urine is specially apparent in tuberculosis, as a very badly diseased organ may be removed while its fellow is not intact. By these two methods of diagnosis one can estimate whether or not the second kidney is capable of doing the work of both.

In two cases of renal tumor δ was 0.69 and 0.66. In the former there was bilateral cystic disease. The patient when seen was uræmic. On the assumption that there was bilateral calculous disease, the organs were incised. At the post-mortem no secreting tissue could be found.

In the second case (δ= 0.60) there was suprarenal struma with nephritis. Compensatory hypertrophy of the opposite kidney gradually raised δ to normal. The disease was extirpated. Recovery.

In two cases with normal blood freezing point unilateral tuberculous renal disease was found and the organs removed. Recovery. Death after a long time from pulmonary disease and from cirrhotic liver. The obduction in each case showed the remaining kidney healthy. When the freezing point of the blood (δ) is 0.60, nephrectomy is contraindicated. Under such circumstances, if the disease is unilateral, one should wait until the healthy organ successfully undertakes the work of both, or the diseased organ may be split open and drained. If the disease is bilateral, only nephrotomy must be thought of, or complete abstention from operation. Where there is bilateral closure of the ureters, the stones must be removed, and if things progress favorably the freezing point soon becomes normal.

Comparison of the freezing point of the urine obtained from the two kidneys separately permits an approximate estimation as to whether a large or small portion of renal tissue is destroyed. This information aids the surgeon in deciding whether a conservative or radical operation is preferable.

The author thinks that the estimation of the functional activity of the kidneys by the means alluded to should be a constant

preliminary to any operative interference in those cases of nephritis which have been until recently in the domain of internal medicine.

Two conditions in particular lead patients with renal disease to consult the surgeon, viz., pain and hæmorrhage. A pain which may be dull and continuous or periodic, increasing to colic, is much more common in nephritis than is usually admitted. In such cases ureteral catheterization and determination of the freezing point (both of blood and each sample of urine, J. F. B.) will easily establish the presence of nephritis.

The significance of hæmorrhage has recently been much ventilated. Is there such a thing as renal bleeding without any pathologico-anatomic change, *i.e.*, an angioneurotic form, or are nephritic changes the cause of the bleeding On examination of the published cases, the author agrees with Israel in the opinion that up to this time only those of Schede and Klemperer deserve to be considered as cases of hæmorrhage without recognizable cause.

Is there such a condition as unilateral nephritis? The author, after much research, cannot admit that such is the case.

If we find in the urine from one kidney, albumen, tube casts, blood, while the urine from the other organ remains normal, then we can, with great probability, diagnose some other disease, *e.g.*, stone, tumor, etc., causing inflammation of the otherwise healthy kidney tissue.

The author points out the possibility of error in the cases of nephritis operated on by Edebohl and others, since there is no evidence that they used the diagnostic means advocated by him, and which he considers of supreme importance for a correct appreciation of renal conditions.—*Verhandlungen der deutschen Gesellschaft für Chirurgie*, 1902; *Centralblatt für Chirurgie*, 1902, No. 26.

JOHN F. BINNIE (Kansas City).

EXTREMITIES.

I. Dupuytren's Contracture. By DR. P. JANNSEN. The author bases his study on sixteen cases observed in Von Bergmann's clinic last year. The specimens obtained in seven of these cases were examined microscopically. The disease was observed in the young as well as the old, in the left hand nearly as often as the right; although, if trauma is an etiological factor, the right hand ought to suffer much more commonly. Involvement of the thumb was noted in several cases. The time taken by the disease to develop varies from months to years. The author excludes trauma as a cause because of the frequency with which both hands are affected. Treatment is purely surgical and must be very radical. Simple division of the bands gives temporary results, but recurrence in from one to one and a half years is inevitable. The author notes recurrences after the Busch and the Kocher operations, and considers these not sufficiently thorough. Lexer has advised excision, not only of the whole aponeurosis, but of large portions or all of the skin of the palm when it is adherent to the aponeurosis. The operation is, of course, severe, but is necessary even in mild cases to avoid recurrence, and according to circumstances is performed more or less as follows: Use the tourniquet. From the origin of the palmar fascia make a longitudinal incision to the finger most affected. Make a second incision along the most distal transverse furrow of the palm, crossing the first cut at right angles. Dissect the four skin flaps thus outlined from the aponeurosis. Portions of skin very firmly adherent to the aponeurosis must be excised with it. It is necessary to dissect the skin from the finger as far down as possible, as it is of prime importance to remove thoroughly the aponeurotic extensions. Excise the aponeurosis. Remove the tourniquet. Attend to hæmostasis. Close the wound with sutures or make use of a flap with a pedicle to cover the wound. Apply the dressings with very great care while the patient is still anæsthetized. Use a volar splint. After two and a half to three weeks begin giving baths and energetic

massage. The results observed up to two and one-half years post-operative have been very good, and are in direct proportion with the thoroughness of the operation. Microscopic examination shows that the disease does not affect the whole fascia, but only and always very circumscribed areas, which are often scattered, and are recognizable by the small swellings they form. A very few vessels and nerves pass through the normal fascia, following the interstices of the connective-tissue bundles. New cellular tissue with marked proliferative tendency is to be seen in the connective-tissue spaces spreading between the connective-tissue bundles and separating them.

The nuclei of the invading cells are large, spindle-shaped, and broad in the middle. This new tissue changes, shrinks, and contains many elastic fibres. Remains of old or recent hæmorrhages are frequently seen. There is a great increase in the number of capillary blood-vessels, and one sees that the neoplastic cellular tissue arises from the new-formed adventitial sheaths of vessels. There is a great hypertrophy of the walls of the larger vessels. The connective tissue of the nerves is increased. Nerve degeneration is a secondary phenomenon. As a result of his investigations, the author assumes that there is a local tendency to connective-tissue hypertrophy in the hand, and that as a result of circulatory disturbances contraction follows. Probably the influence determining the hypertrophy reaches the palm *via* the blood-vessels, but what this ultimate cause is, remains unproved. One cannot yet assume any specific cause of the disease, such as uric acid diathesis, bacterial products, etc. Nervous influences certainly do *not* play the rôle ascribed to them by individual neurologists, and the influence of traumata may be excluded.—*Archiv für klinische Chirurgie,* Band lxvii, Heft 4.

BONES.

I. The Primary Suture of Fractures. (Discussion at the Congress of the Deutsche Gesellschaft für Chirurgie of 1902.)

F. VÖLCKER (Heidelberg) said that experience in the Heidelberg clinic shows the indications for the operative treatment of subcutaneous fractures to be limited.

The danger from infection is slight in operation when the bone is easily accessible, *e.g.*, in the tibia. Asepsis is less certain when the bone lies deep, *e.g.*, femur, and especially in epiphyseal fractures.

Suture of fractured bones usually leads to delay in consolidation, and occasionally to sinus formation and subsequent overriding of the fragments. The principal field for primary operation is in cases of complicated fracture where the exact application of a dressing is very difficult, and treatment is much simplified by fixation of the fractured ends.

Hope in the treatment of subcutaneous fractures lies, not in the domain of operation but in improved means and methods of dressing. Where such cannot be obtained, the question of suture arises, especially in the young, but the value of suture in fractures of the diaphyses is lessened by the fact that it delays consolidation. Two fractures existing at the same time in the same limb are best treated by operation.

Unfortunately, bone suture is most difficult in those cases where improvement in our results is most necessary, viz., in fractures involving articulation.

W. ARBUTHNOT LANE stated that he had, for many years, watched the effects produced by the carrying out of various trades and handicrafts on the bones and joints of the workmen. From an examination of the skeleton alone he can even distinguish that of one who has been a coal heaver from that of a coal trimmer. The bones and joints develop peculiarities to suit the needs of the individual, and may thus deviate far from the accepted normal. From a very extensive study of old fractures, seen in the dead house, Lane has noted two facts specially: (1) that the re-establishment of continuity and the repair of the bone is very unsatisfactory and incomplete; and (2) that just as the peculiarities of

various trades lead to alterations in articulations, so do faults in the reposition of fractures, causing more or less angular union, lead to abnormal lines of pressure acting on the joints and consequent deformity. The amount of joint deformity varies with the amount of angularity at the line of union, and also with the age of the patient at the time of injury. In the young the epiphyseal line will form bone abnormally, and thus modify the articular end, so that after a short time the function of the joint may be carried on effectively and painlessly. This occurs under the law that "the degree of bone formation in the different parts of an epiphyseal line varies with the pressure exerted on it." After the diaphysis and epiphysis have been united and up to about the thirty-fifth or fortieth year, alterations in the mechanism of a joint lead to definite changes in its form due to formation of new bone and cartilage or to absorption of old bone. After this period of life unusual pressure leads to destruction of articular cartilage and the underlying bone, followed by the formation of new bone at the margins of the articular surfaces. Persuaded by the above observations, made in the dead house, that the results of treatment in fractures are unsatisfactory, the author examined a large number of hospital patients with fractured lower limbs with regard to their mechanical and æsthetic disability as well as to the financial loss they incurred through their accident. He found that the opinions commonly held by surgeons as to the effectiveness of manipulations and splints are ridiculously false. The financial loss to the patient entirely depends on his business, often in masons, decorators, and sailors amounting to compulsory and complete change of work. What factors render it difficult and often impossible to obtain good results? Up to the present it has been taught in England "that if the fragments of a broken bone are not brought into correct apposition, the surgeon has not done his work methodically," and that it is the spasmodic contraction of the muscles on the broken bones which hinder their reposition.

It is clear that both these ideas are wrong. The first is shown

incorrect by Lane's researches on both the living and the dead who had been treated in the great hospitals of London; the second from the fact that the muscles are relaxed in complete anæsthesia, and yet it is impossible to place the broken bones into their normal form.

The author opines that the muscles and soft parts around a tubular bone form in their length rigid nodes, and that the resistance, which prevents accurate reposition of the fragments, is caused by a shortening of these nodes through hæmorrhage, and later through inflammatory changes. The resistance to correction is directly proportionate to the extent of the hæmorrhage and inflammation. Apart from operation only two methods of treatment are therefore proper. These consist in reduction by manipulation, if reduction thus is possible before hæmorrhage has occurred, or in waiting until the effused blood is absorbed and the inflammation has gone down. To the latter plan the objection holds that the soft parts rapidly shorten and cannot afterwards be lengthened. The author believes that complete restoration of form in cases of fracture with longitudinal over-riding of the fragments is only possible by the aid of an operation, and that this is more frequently required in the lower than upper extremity. Lane applied this principle at once to the treatment of simple fractures. By applying strong extension to the leg and by using levers and strong bone forceps, he was able to get exact apposition of the fragments of the tibia and fibula even when the amount of effused blood and the inflammation were considerable. Far less force was required to attain the same result in fractures of the femur and of the upper extremity.

Lane's researches show that text-book descriptions of fractures are incorrect in almost every particular. Bones fractured by direct violence show transverse or more or less oblique fracture surfaces and are often splintered. Those broken by indirect violence are always spiral, each fragment ending in a long sharp point. The chief difficulty in reducing spiral fractures of the

tibia and fibula lies in the fact that they are double, and the two breaks do not correspond. In most cases correction of the fracture of the tibia by operation permitted the fibula to resume its normal shape, and the latter bone did not require to be exposed.

To maintain apposition, thick wire of pure silver or ordinary joiner's screws were used. To avoid danger of infection from the use of fingers in the wound, the bones were very freely exposed by a very long incision, and were manipulated with instruments. Unless the asepsis is perfect, the wire or screw nails act as foreign bodies.

Operations on recent fractures are child's play compared to those on badly united and corrected breaks, *e.g.*, when two bones, as the tibia and fibula or radius and ulna, must be divided in four different directions before the correct axis of the two bones can be attained.

FRITZ KÖNIG (Altona) claimed that exact apposition is not of such supreme importance for obtaining good function. He demonstrated the skiagram of a cured leg fracture where there was marked dislocation, yet an excellent functional result. While this is true of fractures of the shaft, it is otherwise in those involving or close to the joints. The shortness of the fragments renders reposition and retention difficult and poor results common. The advantages of bone suture are close approximation, avoidance of extensive callus (very important in articular fractures), and the possibility of moving the injured member at a very early date (from the third week). The last is of special moment in those past their youth. In the neighborhood of joints the result is often faulty, rarely because of pseudarthrosis, more frequently because of restricted field of joint motion. Severe crushing fractures are followed by excessive callus and a bad result. All these forms often call for a late operation, of which the technique is difficult and the functional prognosis is bad, while early operation is easy and gives good prospects. Good skiagrams give information as to the changes of bad or delayed union, and hence indications for early operation.

In one case of elbow-joint and five of shoulder-joint injury, he began by non-operative treatment, but as the result of examination of a skiagram taken five days later he operated at the end of the first or in the second week.

In two of the shoulders the destruction of bone was so great that resection was performed. The result of bone suture was demonstrated in a man of forty-two years, with an oblique torsion fracture of the tubercle region of the humerus with abduction of the proximal fragment; the biceps tendon was hooked on the point of the lower fragment. Motion was begun in the third week, and in the fourth week the arm was used in swimming. Röntgen rays showed complete reposition.

König obtained recovery by operation without much callus and with good function in a boy of fourteen who had sustained an oblique fracture of the external condyle of the humerus with subluxation of the forearm bones upward, backward, and outward.

TRENDELENBURG (Leipzig) only operates in fractures involving or close to joints. In fractures of the hip he introduces a screw through the trochanter into the head.

PFEIL-SCHNEIDER (Schönebeck) said that ten years ago he advised primary suture in fractures to the Congress. Screws have the disadvantage that they do not heal *in situ*. Silver wire almost always heals, but is not firm enough. He had treated twenty-nine cases with silver wire and six with screws. The latter presented slow consolidation and little new formation of bone, so that in one case the first attempt at walking caused a new fracture.

KÖRTE (Berlin) disapproves of primary operation in fractures being proclaimed a general principle. It can only be proper when other means are contraindicated.

HENLE (Breslau) spoke of the defective consolidation after primary suture, especially in the diaphyses. The results are better in fractures of the epiphyses. In Breslau, fractures in the neighborhood of the joints are treated by extension, and massage is generally begun after nine days. The functional results are very good in spite of deficient anatomic restitution.

LAUENSTEIN (Hamburg) drew attention to radial paralysis following oblique fractures of the humerus with much displacement. Spiral fractures exist which cannot be reduced. Such breaks require suture. Silver wire is only serviceable in the patella. For other cases he recommends Hansmann's screws, having used them in more than sixty cases. He has never noticed a protracted formation of callus; after four weeks the screw is loose and is removed. The duration of treatment is lengthened both when screws or wire are used The speaker gave a warning against early massage.

SCHEDE (Bonn) uses ivory pegs in intracapsular fractures of the hip. He has used iron and gold nails for the same purpose. He has given up the use of aluminum bronze.

SCHLANGE (Hanover) warns against too frequent operation. According to circumstances, he operates in fractures of the patella and olecranon and in articular fractures complicated with dislocation.

BIER (Greifswald) drills the fragments and leaves the drill *in situ* as a nail. Suture he rarely uses. In fracture of the neck of the femur no dressing should be used, the patient being merely laid in a proper position.

KOCHER (Bern). Suture in fractures of the diaphysis is exceptional. In those of the apophyses, *e.g.*, tearing loose of the tuberculum majus, operation is the rule, and the same is frequently true in epiphyseal fractures, especially in children. Operation is eminently proper in fractures at the elbow. It does not matter what material is used for suture,—silver, silk, or screws.—*Verhandlungen der deutschen Gesellschaft für Chirurgie: Centralblatt für Chirurgie*, July 20, 1902.

JOHN F. BINNIE (Kansas City).

REVIEWS OF BOOKS.

THE INTERNATIONAL TEXT-BOOK OF SURGERY. In two volumes. By American and British Authors. Edited by J. COLLINS WARREN, M.D., LL.D., F.R.C.S. (HON.), Professor of Surgery, Harvard Medical School; and A. PEARCE GOULD, M.S., F.R.C.S., of London, England. Second Edition, thoroughly Revised and Enlarged. Philadelphia and London: W. B. Saunders & Co., 1902.

It was the pleasant task of the writer to review the first edition of this work when it appeared in 1900. That a new edition should be called for after so short an interval is sufficient evidence of the estimation in which the profession has held the book. Neither publisher nor editors have been willing to put forth the new edition without such additions and changes as the lapse of two years have rendered necessary. The completeness of the earlier edition may be judged of, however, by the comparatively trivial changes which appear. These are of value, and put the work abreast of the times. The chapter on the surgery of the lymphatic system has been much improved, and the operative treatment of tubercular glands is treated in a more modern spirit, partial and incomplete methods being given the place they deserve, while due stress is laid upon the careful and exact surgery that more complete operations require. Some additions have been made to the chapter on the surgery of the spleen. Throughout the book one finds new illustrations, which increase the value of a work already profusely illustrated. The chapter on military surgery has been enlarged and many new plates introduced. Some matter, however, has been omitted which will be missed. Numerous statistical tables have been added to the chapter on naval surgery which will prove useful and instructive. One of the most valuable additions to the

book is the article on the therapeutics of the Röntgen ray. A full account is also given of Finsen's light treatment of lupus and allied affections. In the chapter on injuries of the joints no mention has been made of the method of treating sprains first advocated by Callender and since popularized in this country by Gibney, of New York. Nor has the carbolic acid and alcohol treatment of tuberculous joints advocated by Phelps received attention in the article on diseases of joints. In the same article the author confuses rheumatoid arthritis with arthritis deformans. The first is a true gouty affection of the joints, and seems to have a predilection for the shoulder-joint, whereas arthritis deformans, a totally different disease, is an arthropathy of nervous origin, and up to the present time quite incurable, which is not the case with true rheumatoid arthritis. The plate which is intended to illustrate rheumatoid arthritis is in fact a typical picture of the hands and feet in arthritis deformans. In the chapter on malignant growths no mention has been made of the work of Plimmer and Russell in England, of San Felice in Italy, nor of Park and Gaylord in this country. The work of all these observers is of sufficient importance to demand passing mention even from the most convinced adherent of Cohnheim's theory.

The new edition of Warren and Gould will be as popular as its predecessor. It is an admirable exponent of the art and science of surgery and reflects credit on editors and contributors alike.

ALGERNON T. BRISTOW.

DISEASES OF THE STOMACH. By JOHN C. HEMMETER, M.D., Philos.D., Professor in the Medical Department of the University of Maryland, etc. Third Enlarged and Revised Edition. Philadelphia: Lea Bros. & Co., 1902.

The volume before us consists of nearly 900 pages, and is the result of great erudition and a vast amount of painstaking labor. While primarily it is intended for the internist or, to use the author's term, the clinicist, yet there is much of value to the

surgeon scattered throughout Hemmeter's book. The volume is divided into three parts:

I. Anatomy and Physiology of the Digestive Organs; methods and technics of diagnosis.

II. Therapy and Materia Medica of Stomach Diseases.

III. The Gastric Clinic.

In Part I a thoroughly up-to-date and satisfactory account is given of the anatomy and physiology of the stomach. The methods of diagnosis described and practised by the author are so numerous and thorough that the reader is filled at once with satisfaction because of the progress attained and with pity for the patients because of what they must endure.

In Part II two chapters are devoted to the principles of dietetic treatment of gastric diseases and to proper cooking. Many and useful diet lists are given. The subject of rectal feeding and the constitution of the best nutrient enemata are not forgotten.

The surgeon naturally turns with most interest to the short chapter entitled "Surgical Treatment of Organic Gastric Diseases." The views expressed here are most sensible, and make one wish that every "clinicist" would read, digest, and promptly act upon them. For example, "Our experience is that the sooner gastrostomy is performed in carcinoma of the cardia the longer is the life sustained. One should not wait until nothing but liquids will pass the stricture." (Page 353.) "Exploratory laparotomy, which Haberkant states to be the *only reliable* means for making an early diagnosis of carcinoma, should be encouraged by the internist, not because carcinoma can be diagnosed with certainty thereby, for it really cannot, as the stomach is the seat of many kinds of neoplasms, and even ulcer, with indurated edges, may simulate carcinoma," etc. And again, "The practitioner should not be too guarded in advising exploratory laparotomy in cases of rapidly developing cachexia and emaciation with the symptoms of chronic gastritis and absence of hydrochloric acid. Tentative treatment should not be prolonged over three weeks. It is not near so serious a fault to have caused the opening of a

stomach and found nothing operable, as to permit a case to continue and find out, at the autopsy only, that it was a circumscribed carcinoma, the removal of which might have prolonged life for years. The author has been responsible for three exploratory laparotomies at which nothing was found, although cancer was suspected in one and ulcer in the other two. The cases recovered, and were cured of their symptoms of pain and vomiting." As regards indications for operation, the author writes, " There cannot be a moment of doubt about the feasibility of operation when gastric dilatation is manifestly due to palpable neoplasm, even if it were not malignant. But we generally advise operation in case (1) dilatation is associated with cachexia; (2) absence of hydrochloric acid in the gastric contents; (3) excess of lactic acid; (4) presence of the Oppler Boas bacillus."

Hemmeter, as a result of his experience, lays great stress on the presence of the Oppler Boas bacillus in making the diagnosis of cancer. In fifty cases of gastric cancer examined by the author and his assistants, the Oppler Boas bacillus was present forty-nine times, while in eighteen cases of gastric ulcer it was not found even once.

The author, when discussing gastro-enterostomy, does not presume to choose between the posterior or the anterior operation, but he does deny the physiological rotation of the full stomach around its long axis, whereby the large curvature is turned anteriorly and the small posteriorly. This hypothetical position of the stomach has been held to be an objection to anterior gastro-enterostomy.

Mayo, in a recent article on gastro-enterostomy, states that if the anastomosis is made low down on the stomach, his experience shows that it does not matter whether the operation involves the anterior or the posterior gastric wall. Thus the views of the Minnesota surgeon confirm Hemmeter's opinion. The whole of the book under review is excellent and constitutes a great storehouse of information.

JOHN F. BINNIE.

THE PRINCIPLES OF BACTERIOLOGY: A Practical Manual for Students and Physicians. By A. C. ABBOTT, M.D., Professor of Hygiene and Bacteriology, University of Pennsylvania. New (sixth) edition, revised and enlarged. 12mo; 636 pages, with 111 illustrations. Philadelphia and New York: Lea Brothers & Co., 1902.

This volume is of moderate size, and forms a concise and practical manual of bacteriology which well meets the needs of the student and the general practitioner. That it has found favor is evidenced by the fact that it has passed through six editions in ten years, enabling the author to revise and add to the work at short intervals, thus following closely the chief advances made in bacteriological research.

The first portion of the work deals with a general discussion and description of the bacteria, methods of sterilization, the preparation of nutrient culture media, the technique of making cultures and staining, and the inoculation of animals with their post-mortem bacteriological examination. The second portion describes the more important species of bacteria, discusses infection and immunity, and gives the methods of testing disinfectants and antiseptics, of performing experiments in skin disinfection, etc.

The new matter added to the present edition includes descriptions of the organisms concerned in the causation of epidemic cerebrospinal meningitis and dysentery. There is also presented a summary of the so-called "acid-proof" bacilli, which in their staining peculiarities and their morphology are in many instances so much like the bacillus tuberculosis as to cause them to be mistaken for the latter. The differential diagnosis of these forms is detailed. A description of the pathogenic streptothrices is included in this edition. The excellent chapter on infection and immunity has been brought well up to date, presenting the most recent views and theories of the prominent observers upon this interesting subject.

Altogether, this work covers the subject of practical bacteriology in a clear and systematic manner, and as completely as

could be expected in a work designed to be kept within the limits of a convenient hand-book.

RICHARD W. WESTBROOK.

A TEXT-BOOK OF PRACTICAL THERAPEUTICS. By HOBART AMORY HARE, M.D. New (ninth) edition. Philadelphia and New York: Lea Brothers & Co., 1902.

The impression received from a somewhat careful perusal of this latest edition of "Practical Therapeutics" is that the author has compressed within the limits of one octavo volume, of over 800 pages, a vast amount of useful information, thoroughly in touch with modern requirements, and so arranged as to be easily available.

It appears to embody all of the essentials to be found in the author's more ambitious publication upon the same subject, with very few, if any, of its disadvantages. The subjects treated are admirably condensed without any appreciable loss, and in numerous instances many pages of tedious descriptive writing are replaced by suitable illustrations, giving at a glance a comprehensive understanding of many of the more technical therapeutic procedures. In this particular it is especially useful to students. Among the subjects so treated are: gavage, lavage, leeching, cupping, use of the hypodermatic syringe, and the various methods of applying cold water as a remedial agent. By the same means valuable hints are also made concerning the methods employed in the application of hypodermoclysis, the hot-air bath, intravenous injection of saline solution, and lung expansion or pulmonary gymnastics. The history of antitoxin, its dosage and method of administration, are all clearly outlined. In fact, useful data upon a large variety of subjects, formerly widely scattered, are here to be found in addition to a treatise upon drugs, feeding of the sick, and an alphabetical list of diseases, with brief accounts of each and the therapeutic measures employed for their relief. It is a book which we can highly recommend.

FRANK WHITFIELD SHAW.

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A Monthly Review of Surgical Science and Practice

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WILLIAM WHITE, PA.D., M.D., OF PHILADELPHIA. WILLIAM MACEWEN, M.D., OF GLASGOW.

W. H. A. JACOBSON, M.Ch., OF LONDON.

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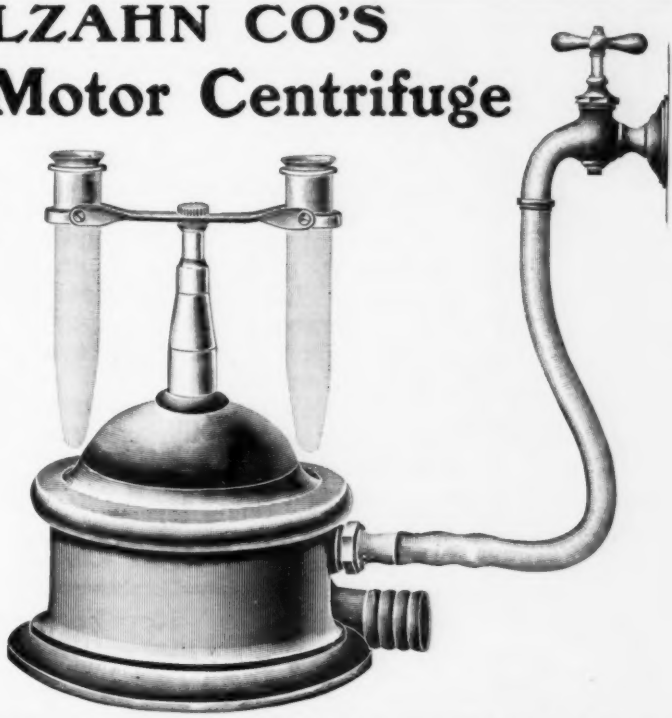

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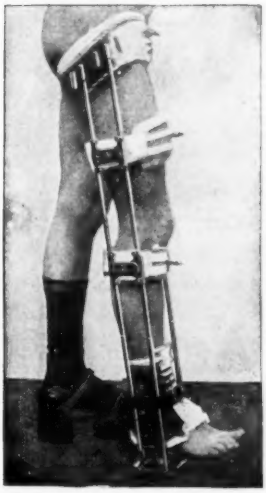

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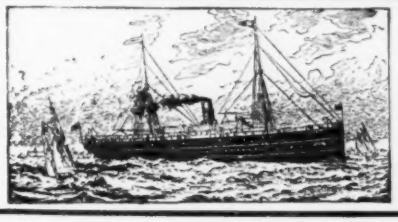

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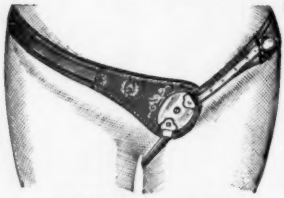

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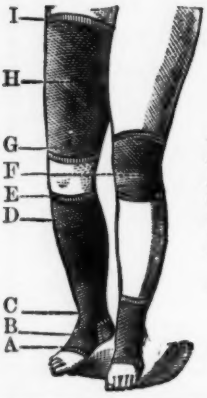

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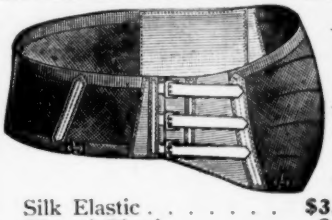

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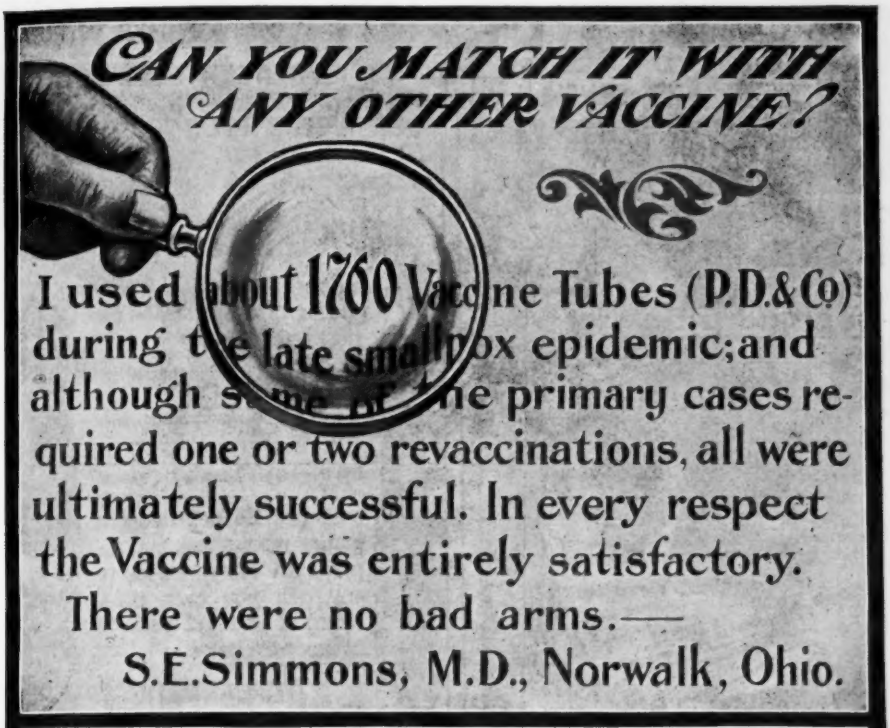
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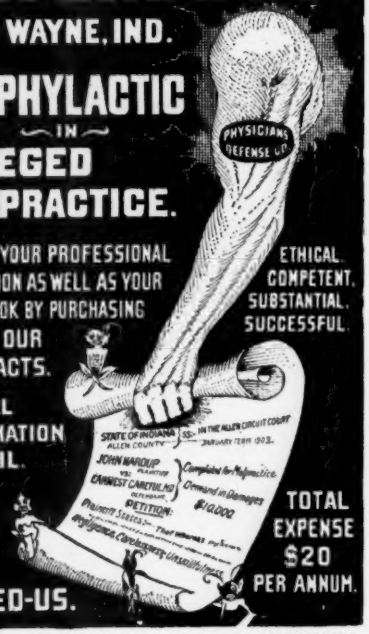

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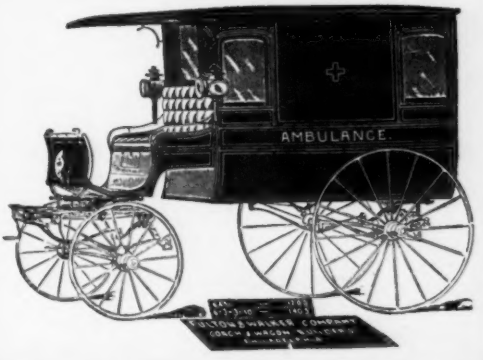

FIFTY-EIGHTH YEAR

Buffalo Medical Journal

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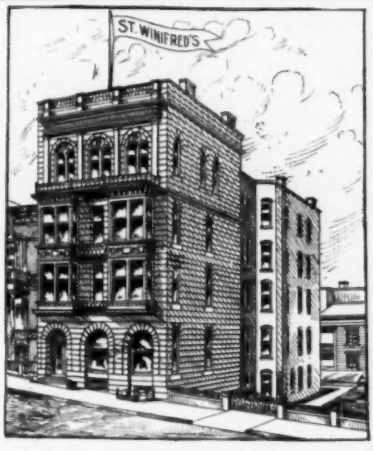

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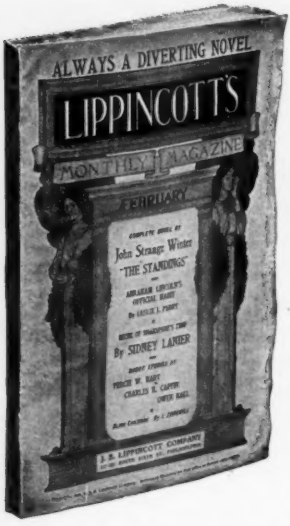

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Lippincott's Magazine

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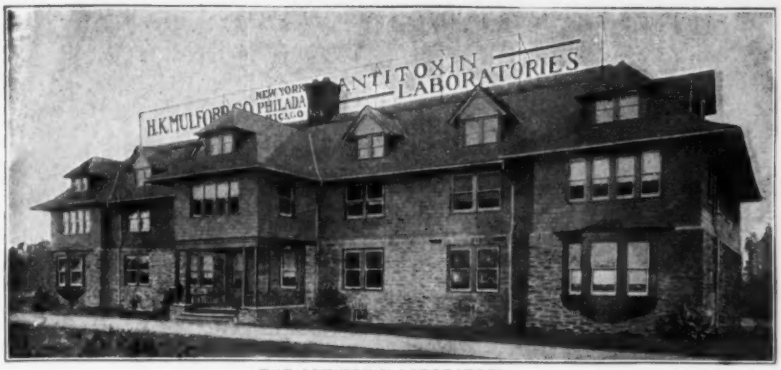
¶ Names of distinguished authors of fiction who have written for this Magazine might be quoted by the score: Doctor S. Weir Mitchell, Owen Wister, John Luther Long, Maurice Hewlett, Alice Brown, E. W. Hornung, Cyrus Townsend Brady, Charles G. D. Roberts, these are a few names of LIPPINCOTT'S contributors.

HOW MULFORD'S ANTITOXIN IS MADE



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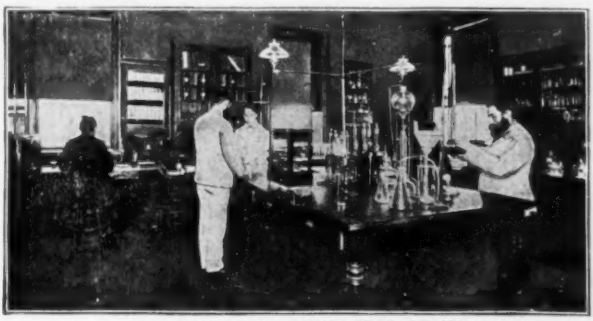

ONE OF THE RESEARCH LABORATORIES

THE STABLES

three in number, have accommodations for one hundred and fifty horses. Each animal is confined in a separate stall provided with individual water supply, ventilation and drainage. Hygienic experts pronounce these stables models of sanitary perfection.

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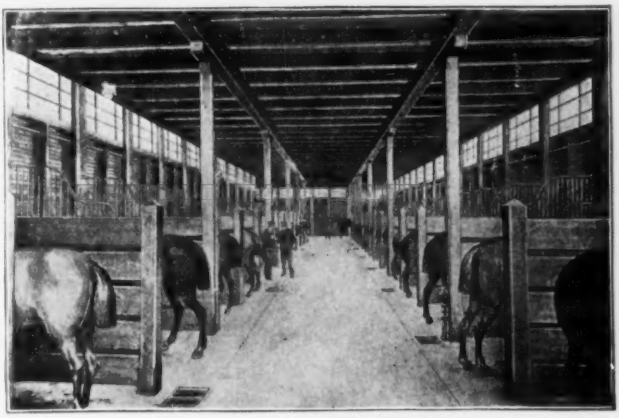

ONE OF THE ANTITOXIN STABLES

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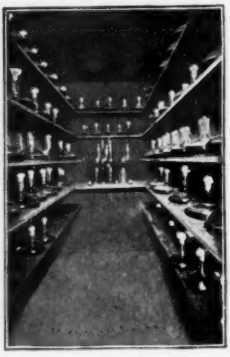
Mulford's Antitoxin is prepared in accordance with the most rigid requirements of science; surgical, germ-free cleanliness characterizes every step of its production; the antitoxin never comes in momentary contact with the atmosphere; the exact unit-strength of toxins and antitoxins is determined with absolute mathematic precision; the purity and strength of each separate yield of antitoxin is determined by repeated series of tests upon guinea-pigs

The production is so completely surrounded with safeguards that contamination can never occur.

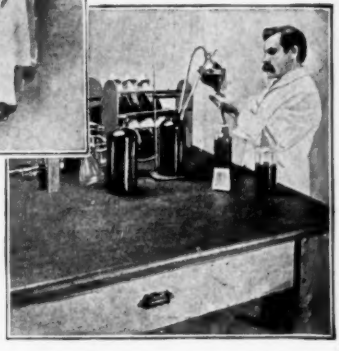


INCUBATION ROOM

FILLING ANTITOXIN IN ASEPTIC BULBS

BLEEDING HORSE TO OBTAIN SERUM

FILTERING ANTITOXIN



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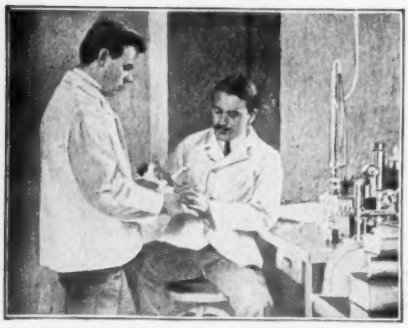
Especially to be emphasized is the elaborate system of testing the serum. At least fifty guinea-pigs are required to determine the purity, unit-strength and non-irritating character of each separate yield of antitoxin.



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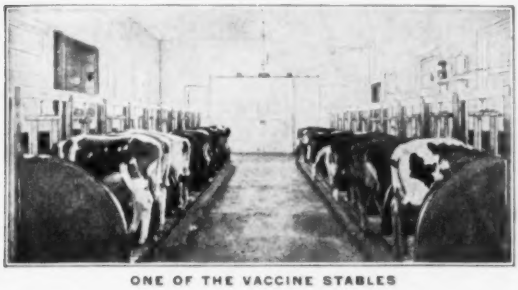
HOW MULFORD'S VACCINE IS MADE

THE VACCINE LABORATORIES

THE VACCINE LABORATORIES are entirely separate and remote from the Antitoxin Laboratories; they were constructed after careful inspection of the leading government vaccine establishments of Europe. The buildings embody all the latest features of sanitary construction with the details observed in modern hospitals and hygienic laboratories; no other vaccine plant is so extensive and complete.

The inoculation of animals and collection of virus are performed in a strictly aseptic manner in an operating room located in a separate building remote from stables.



ONE OF THE VACCINE STABLES

THE STABLES accommodate one hundred calves, each of which is confined in an individual compartment. The floors, walls and ceilings are of cement, slate and porcelain finish and are frequently and thoroughly flushed and disinfected. The stables are heated and ventilated by the direct-indirect systems. The calves are fed exclusively upon milk and the excretions are disinfected and removed as soon as voided. Each separate building is a hygienic model, and the principles of asepsis are as rigidly adhered to as they are in the operating room of any modern hospital. Every calf is kept constantly immunized against tetanus by the injection of tetanus antitoxin, and is also injected with tuberculin in order to assure its freedom from disease; furthermore, each animal is subjected to a thorough physical examination by our veterinarian, who is in constant attendance.

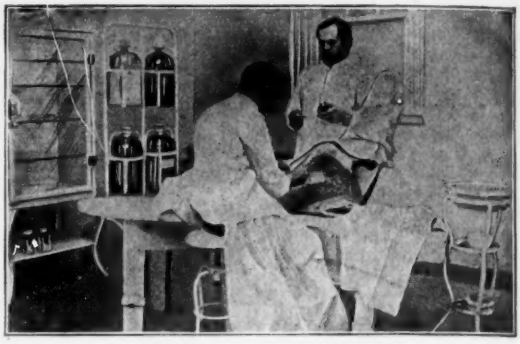
ANIMAL TESTS After the collection of vaccine each animal is killed and subjected to a careful post-mortem examination. **The virus from absolutely healthy animals is used exclusively.** Furthermore, tests are made on guinea-pigs in doses one hundred times as great as would be used for vaccinating a child. These procedures preclude absolutely the contamination of **Mulford's Vaccine** with toxic germ-products.

MILK IS USED EXCLUSIVELY IN FEEDING CALVES

HOW MULFORD'S VACCINE IS MADE

THE OPERATING ROOM

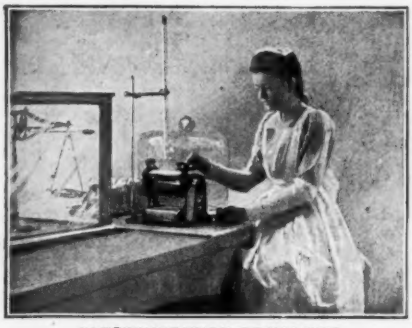
in which the inoculation of animals and collection of virus are executed, is maintained so rigidly aseptic that in it abdominal operations upon the human being could be safely performed. Everything connected with the collection of virus—instruments, apparatus, towels, etc.,—are sterilized by the most approved methods. The entire room is daily flushed with antiseptic solutions and disinfected with formaldehyde.



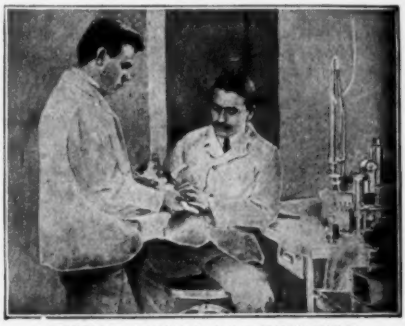
THE COLLECTION OF VIRUS

COLLECTION OF VIRUS

After the vaccine is collected it is ground between glass rollers upon which Glycerin (C. P.) is gradually dropped from a graduated pipette. **Crusts are never used.** Every drop of



GLYCERINIZATION OF VACCINE



TESTING VACCINE ON GUINEA-PIGS

Mulford's Glycerinized Vaccine is of uniform potency and activity. After trituration, the glycerinized virus is stored and subjected to repeated bacteriologic and physiologic tests.

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The capillary tubes are filled, by means of a vacuum apparatus, with bacteriologically and physiologically tested vaccine and hermetically closed, so that outside contamination is impossible. Each individual tube is, therefore, of guaranteed purity and activity.

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GLYCERINIZED LYMPH, in Capillary Tubes (10 vaccinations)	**$1.00**
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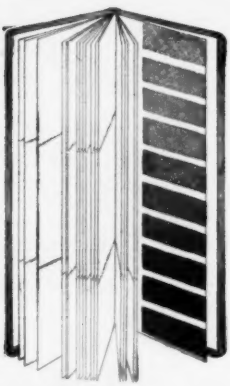

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CASE IV.—*Violent Endometritis Cured by Applied Blood, without Curettage.*—Florence B., aged 30 years; American. Diagnosis: Endometritis. Patient admitted to hospital March 2, 1902. She was greatly anæmic and emaciated. Was so weak that she had to be carried from the carriage to her bed. Discharge was so profuse that unless proper appliances were used it would run from her almost constantly.

This condition had existed for four years, and during that period she had been twice curetted, but no result or relief obtained. Examination revealed the uterus to be in a highly diseased condition. So much so that I advocated a vaginal hysterectomy, or at least a thorough curettement. To these propositions both the patient and her friends absolutely declined to agree, and begged that I employ some other treatment. I therefore, without any promise of result, determined to employ bovinine injections and applications. On the 3d of March, after the patient's secretions had been regulated, I commenced treatment by washing out the uterus and injecting a solution of bovinine and salt water, two-thirds bovinine and one-third salt water, and tamponing the vagina with bovinine pure. Internally she was given two teaspoonfuls of bovinine every hour in peptonized milk and a little water. The vaginal injections and tamponing were employed twice in twenty-four hours, up to March 14th. At this time the discharge had entirely ceased and the uterus was becoming smaller. The uterine washings now were employed once in twenty-four hours and, instead of bovinine tamponings, vaginal injections of the bovinine pure. Internally, the bovinine was increased to a wineglassful every two hours. March 18th, the patient was up, and went for a short walk, and returned in splendid condition. Had gained four and three-quarters pounds in weight. On March 23d, the uterine injections were discontinued, and the vaginal injections employed once in twenty-four hours. At this time the uterus had assumed its normal size, and all evidence of inflammation had disappeared. The patient was looking and feeling splendidly. Therefore local treatment was discontinued. April 1st, she was discharged cured, but instructed to return at intervals for examination and continue the bovinine internally indefinitely.

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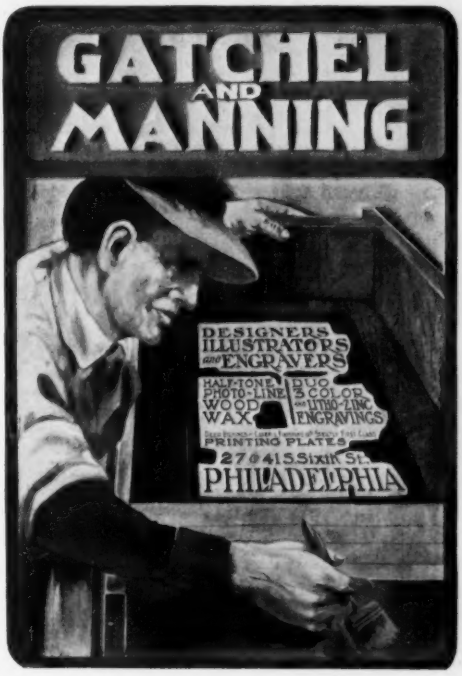

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In 1842 he advanced the view that the characteristic leucocytes of acute inflammation were the direct result of multiplication of connective-tissue corpuscles. This theory incited dispute and stimulated investigation. Addison and Waller contended that white corpuscles passed directly through the wall of a blood-vessel. Discussion and research went hand in hand, swinging on the pivot point of the cell, *per se*. Cohnheim definitely proved the identity of the white corpuscles and, while overthrowing the theory advanced by Virchow, acknowledged that the fallacy of the great observer's original contention was the basis of all future work.

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THE PHOSPHORUS OF THE SYSTEM
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Formaldehyde or methylene is a uric acid calculus solvent, and has been known to dissolve the uric acid deposits left in the joints. It sterilizes the urine and greatly lessens the number of gonococci in gonorrhoea, and maintains a paramount healing influence over the entire mucous surface of the genito-urinary tract.

Salicylic acid in itself is almost the specific for the uric acid diathesis, and its antiseptic properties are well known. But the faults of gastric disturbance and heart depression, have limited the use of this valuable remedy.

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We would suggest the use of five grain doses every two or three hours, or fifteen grain doses every five or six hours.

Yours very respectfully,
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Lewis Sommers.
President.

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